THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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SCIENCE AND INDUSTRY.

IT has been our privilege to attend two conferences at the Mansion House, at which the theme discussed was the need for co-operation between science and industry. One of these was held between nine and ten years ago—it was the inaugural meeting of the British Science Guild, at which the Right Hon. R. B. Haldane was elected first President. Interesting speeches were delivered by men of unquestioned eminence—a Bishop, an Admiral, engineering leaders such as Sir Wm. Mather and Sir J. Wolfe Barry, the respected chief in the world of textiles (then Mr. Macara) and others. The proceedings were well attended and even enthusiastic. If we recollect one feature more vividly than any other it is the speech in which Mr. Haldane, as he then was, extolled the German system in respect of its appreciation of the value of science and scientific principles, and in its method of dealing with the workman who would not work.

Much water has flowed under the bridges since that date; Governments have changed, and the turn of fortune's wheel has brought into power one in which the first President of the British Science Guild forms one of its most distinguished members—now Lord Haldane of Cloan—than whom, we supposed, few knew, or thought that they knew, the soul of Germany better. Within the intervening decade we have witnessed the immense development of Teutonic industries consequent largely upon their full appreciation of the value of scientific production and organisation and financial co-operation, assisted though, as everybody sees now, by unscrupulous machination. The British Science Guild is entitled to credit for all that it may have done to change the attitude of Governments, manufacturers, and the general public towards science, scientific education, and scientific principles, and Lord Haldane is equally entitled to our sympathy if to-day he has to deplore the fact that obsession with the manifold important duties devolving upon a Cabinet Minister, in a decade marked by very democratic tendencies, has prevented him from inducing the British nation to avail itself more thoroughly of the object lessons that he had been privileged to observe in Germany.

The second of the Mansion House Conferences, of which a report appears on another page, was not convened by the same Guild. Yet the speeches of 1915 had very much in common with those of 1905. The hall, the stage, the theme—were the same; there were other actors, but the need for a more general utilisation of science in industry was shown to be still one of the most urgent of all our needs, indeed the urgency of the question was emphasised by the added experience of these 10 years of German industrial advance. But the fact that we are now at death-grips with the people whose system Lord Haldane once extolled, should bring home to the national mind most forcibly the seriousness of the whole question in relation to our future trading abilities. We have ventured to hope that all the industrial lessons that we have been learning or re-learning since last July have persuaded Ministers, manufacturers, and others in authority, that this is no purely academic question, but one in which we are all vitally concerned. Yet, if we were to judge from the proceedings and attendance at this second conference, we should feel that we had yet a long way to go before the real facts had been properly brought home to the public mind. We were permitted to listen to the reading of a chapter

from a book already published, which stated very convincingly once again how science has contributed to Germany's success in economical and competitive production. The audience was very small, but we should judge that those who were present knew the argument full well. There was a brief discussion, in which Sir Philip Magnus very reasonably asked what it was proposed to do to bring about the alteration that seems to be so essential, but it cannot be said that those who asked for bread got anything better than a stone. One of the most telling speeches was that in which Col. Cassel made an indictment of the Government itself—in which Lord Haldane sits upon the Woolsack—for advertising for chemists with high qualifications, for service at Woolwich, at two pounds no shillings and six pence per week! Of what avail is it to agitate for raising the scientific status if the Government itself values the services of scientifically-trained men in so niggardly a fashion, and when it excludes from the Board of British Dyes, Ltd., expert chemists of unquestionable eminence? The first President of the British Science Guild, if he still holds the views of his earlier years, should surely make his voice heard in the councils of his party in these momentous days. How can we expect to raise the status of science if we keep the monetary reward of the scientist below that of the artisan or labourer? The second conference seemed to agree that the matter was not one to tackle in a hurry—no cut and dried scheme could be propounded. How far that attitude differs from the one adopted by the conference of 10 years earlier the few who were present on both occasions may be left to judge. Others who were present last month and care to turn to their Electrical Review for November 3rd, 1905, may feel that there is much in common between the two reviews of the position and of the need for educating the race from top to bottom in regard to the value of scientific principles and their application in every department of life "to the problems which modern life presents in peace or war." Really from the standpoint of conference we do not appear to be any "forrader"—we are as conservative as ever in some things. The resolution passed last month stated that it was desirable, "in order to improve the working conditions in which British industry at present operates, that there should be closer co-operation between industry, science, and finance." In our opinion it does not require discussion to secure approval for that view from such an audience at this late date. What *is* required is that something should be *done*, otherwise we may see the end of this war, and talk on for another 10 years, perhaps losing ground all the while. Since the conference we have received a communication from the Institute of Industry and Science, which convened it, stating that something "will not be disclosed until the dinner which is to be given in about a month's time to leading industrialists, scientists, and bankers." We will endeavour to rest our souls in patience, waiting for something tangible. Publicity galore, advertisement and talk are not a very satisfying diet for hungry men.

Copper.

There has been an uninterruptedly firm tone about the copper market for weeks past, and all the more cautious expressions of opinion which have been met with are now being thrown to the winds, as it becomes more and more probable that there is a big and concerted plan of manipulation at work to rig the market. American producers, stiffened by the contraband policy of the British Government, and backed as all the world knows by important German interests, are engaged in rushing up the price of their product, regardless of the fact that while they have been restraining output, thus keeping labour out of employment, they are also inveighing against the action of the Allied Powers in "stopping their trade." That it is sheer nonsense, does not appear a factor in the eyes of the German coppermongers, who are coining money while Europe bleeds. There is undoubtedly a large consumption of copper, and the full benefit of it falls into he coffers of the American copper producers, who, indeed, are reaping a golden harvest, and who seem able to push up prices much higher still. Their argument that the British Government can afford to pay even £100 a ton is, no doubt, all right, for wars for national existence have to be fought out to the end, regardless of cost, and the German-Americans are no doubt quite wise in their generation in preferring to sit snugly at home in New York or Boston, and coin dollars, rather than put their manhood to the test in Flanders or in the desolation of West Russia. It must be kept ever in mind that half-bred German interests are pretty powerful in America, and when these are linked up in an endeavour to rig the market in conjunction with what are frankly American manipulators, the result can only be higher prices. Output is being kept down as closely as may be to consumption, though the former has undoubtedly increased to a considerable extent lately. It is improbable in the extreme that the copper magnates will permit it to expand to a degree sufficient to permit of a decline in prices, and some of them are boasting now that the policy of small output and big profit has come to stay, as against big output and small profit. This can only foreshadow a period of manipulation, until possibly the American copper trade is again threatened with a Government inquiry based upon anti-trust lines. Something of this is being held over the heads of the American spelter industry now, and may have a restraining effect upon the cupidity of the leaders of the trade. The responsible head of the United States is, however, hardly the man to show stiffness of attitude in any matter requiring the display of virile qualities or statesmanship. There is an additional factor, too, to be considered just now in the copper position, and that is, that the scarcity of vessels is becoming so great that it is a question whether shipments can be made from the United States to Europe on anything approaching the scale necessary to enable goods to be exported. For weeks past metals have been waiting shipment on the quay at New York, and they seem likely to wait there for weeks more. Shipping is not to be had, and this is the plain fact about the matter. Notices have already been given to certain large consumers here that it will not be possible to ship copper bought by them till July, and turn where one will, the same tale is told. Under these circumstances and in view of the manipulation at work, it is impossible to hold very bearish opinions as to the future. America can put prices higher if it is considered desirable, and there is no doubt that the times are regarded as very auspicious for a campaign of squeezing Europe, such as has been initiated, and the early phases of which are now with us.

American Trade Activity.

We have recently had occasion to call attention to the activity which is being displayed by the U.S. Government and American firms generally to take advantage of existing circumstances to improve their position in the world's markets. A further evidence of this activity has now come to our notice, this time with particular reference to the extension of trade with France. The American Consul-General in Paris, it appears, has arranged to publish a weekly bulletin of offers received from the United States giving names and addresses of the firms making the offers and the nature of the goods for sale. These bulletins will be distributed to all the trade organisations in Paris, by whom they will be affixed to notice boards, and they will also be given wide publicity in the monthly journals issued by these organisations. Accompanying each bulletin is an invitation to French firms interested in the offers to call at the office of the American Consul-General to examine letters, catalogues and samples. It is hoped that by giving this wide publicity to the desire of American firms to increase their trade with France, satisfactory business connections will be made directly between French importers and American manufacturers. We cannot approve all the methods adopted by American Consuls in their work, but we can at least give them credit for their energy. This particular enterprise would appear to offer excellent opportunities for good, and now that British Consuls are displaying greater enthusiasm

than ever before, we may hope efforts to similar ends for British trade may be more numerous than they have hitherto been. Another evidence of American activity appears in a cable which has recently been received by the American Government from the Commercial Attaché in Madrid, in which he states that the American Ambassador and he recently had an interview with the King of Spain, in which the latter expressed the opinion that the present moment offered an excellent opportunity for American interests, particularly in the mining and metallurgical industries.

As an off-set to the above, it is interesting to note that the American Consul at Buenos Ayres recently reported that a man of great experience in South America had told him that American firms were making a big mistake in refusing to send travellers to that market. He states that English firms have now five travellers to every three they had a year ago, soliciting orders for any kind of future delivery, as they are determined not to let the market slip away from them. He also says that even some German firms are keeping their South American men active, although no one can tell when they will be able to fill orders.

Preferential Rates.

In our last issue we published a communication from Councillor William Smith, late chairman of the Ilkeston Electricity Committee, on the subject of tariffs for electrical energy, which calls for comment. It will be remembered that Mr. Smith resigned his position in order to champion the cause of a photographer who had been charged for electrical energy at lighting rates, although the photographic lamps of another member of his profession were supplied at the power rate; this case is not on all fours with that brought forward by Mr. H. Faraday Proctor some time ago, the question in the latter case being whether it was lawful to supply such apparatus at the power rate, whereas the former was apparently a true case of preferential charging, which is clearly contrary to the law.

The point to which we wish to call attention is the uncertainty which appears to prevail in some municipal quarters with regard to the powers of the supply authority to formulate special tariffs, as exemplified in the first three questions submitted by the Ilkeston Corporation to the Local Government Board. The reply of the Board is, as Mr. Smith remarks, very significant, but it could have been anticipated by anyone who took the trouble to study the terms of the Electric Lighting Acts, which make it perfectly clear that, provided that the maximum charge specified in the authority's Special Act or Prov. Order is not exceeded, and provided that no undue preference as between consumers of the same class is exhibited, the authority is entirely at liberty to lay down a separate tariff for any and every class of consumer. We need only cite in support of this contention the fact that churches, offices, private residences, public-houses, factories, shops, basements, and other classes of consumer, have been and are differentially treated by various supply undertakers, although they all use the energy supplied for lighting. If energy is supplied for motive power at 1d. per unit, and if it is supplied for photographic purposes at 1d. per unit also, it is a mere coincidence or a matter of convenience that the two rates are identical—they really have nothing to do with one another. Parliament has not laid down any rule that power and lighting shall be charged for at different rates, nor has it specified that they shall be charged for at the same rate; the question is left quite open to electricity supply authorities—provided that no unfair preference is shown as between consumers of the same description. The Electric Lighting (Clauses) Act, 1899, Schedule, Sec. 33, states clearly that "the undertakers may make any agreement with a consumer as to the price to be charged for energy, and the mode in which those charges are to be ascertained, and may charge accordingly. In a word, *preferential* rates are forbidden, but *differential* rates are permitted.

Patents in 1914.

The report of the Comptroller-General of Patents for 1914 naturally differs very materially from those of previous years. The state of war has had various consequences upon both inventors and their inventions, and the all-absorbing subject of war has encouraged inventive ingenuity in military and naval matters, while our relations with other countries led to the passage of special Patent legislation. The statistics are, of course, affected, as the following figures for two years show:—

	1913.	1914.
Patent applications	30,077	24,820
Completed specifications ...	19,309	16,443
Sealed specifications	16,599	15,036
Income	£346,324	£322,829
Expenditure	£194,423	£194,767
Surplus...	£151,901	£128,062

In the course of the usual review of the trend of invention, it is stated that the electrical industry, as a whole, is very prominent, although there are few outstanding features that are considered to call for comment. Continued progress in automatic and semi-automatic telephone systems is noted, and attention has also been given to receiving arrangements for cable telegraphy, and to ionised gas relays for use in telephony and wireless receivers. The subject of locomotion in general still maintains its pre-eminence, and the flow of applications was equal to that of the previous year, until the outbreak of war, when a considerable falling-off set in. Applications in connection with motor-vehicles and internal-combustion engines are still very numerous, but there is a notable falling-off in the total. Tractors for agricultural and military purposes, and signals for indicating to a following vehicle an intention to turn or stop, are mentioned as noteworthy features. The interest in visual signal-indicators for mines has been well maintained. There is a well maintained interest in railway signalling, without any marked departure from known types of apparatus.

Among the war features in the year's record is the stimulus given to aerial warfare and submarine mining. Methods for detecting submarines and torpedoes, and for protecting ships therefrom, are also specially noted. The disaster to the submarine A7 directed attention to the problem of locating wrecked submarines and signalling to, and rescuing, their occupants.

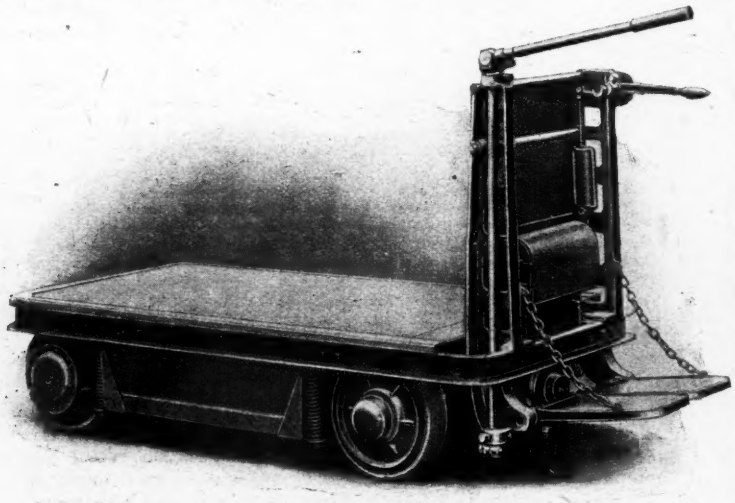
As to the future effects of the war upon invention, we cannot possibly foresee these, but it is certain that we cannot expect to avoid the consequences of wholesale carnage. Among the millions of lives that are being sacrificed are some of Europe's best. Potential genius, germs of inventive greatness, which might have benefited coming generations, are squandered at the bidding of Kultur-cum-Militarism. The world generally is being robbed of its heritage. But there may be compensations as usual. Hundreds of thousands of men will never return to their former occupations, but may be compelled to subsist in calmer spheres where the inventive faculty may have a freer scope. The experiences of the period of war have turned thousands of minds in directions that they might never have followed in continued peace. The new and vast constructive operations that will ensue when the destroyer's hand has been stayed will be sure to give a stimulus to innovation and invention, and the lessons learned from the applications of science in connection with German achievement may lead most countries to desire to spend larger sums upon research and investigation. It may be that, after accounts have been settled, German industrial concerns will have less money to devote in such directions, but though the financial stress and strain may be severe there will be a great unwillingness to cut down such items of expenditure, and inventive advance may contribute largely to the solving of coming problems, for is not necessity still the mother of invention?

C

THE ELECTRIC VEHICLE.

Elwell-Parker Battery Trucks.

We are glad to note that an up-to-date method of handling passengers' baggage, &c., on and about station platforms has recently been introduced by the London and North-Western Railway at Euston. Two Elwell-Parker battery trucks are now in use for conveying passengers' baggage and general platform freight. These were supplied by Mr. J. D. Gillespie, of the Railway Track Supply Co., who are sole agents for the Elwell-Parker Co. This class of truck is now being used in England for many purposes, chiefly amongst the railway companies. The Great Western, Midland, Lancs. and Yorks., and Great Central Railways have one or more Elwell-Parker trucks in use. At the Great Western Company's locomotive works at Swindon 14 Elwell-Parker trucks are employed for conveying works materials from one point to another; the trucks are easy to operate, and can be turned in a short radius. The cost of maintenance is exceedingly low, and the energy consumed very little. The L. & N.W. is the first English railway company to employ these electric trucks generally for platform use, although other railways have experimented with them, and in every case the results have been successful. In the United States electric battery trucks are universally employed, the majority being of Elwell-Parker make.



Electric Baggage Truck supplied to the L. & N.W. Railway Co.

The truck which we illustrate is of 2 tons carrying capacity; its special features are the automatic control, automatic braking and four-wheel steering. It is fitted with an Edison battery, carried in a spring suspended cradle arranged for easy removal of the battery for replacement, and a special motor operating at 24 volts pressure, and capable of running the loaded truck up a 15 per cent. gradient.

The motor and driving gear are enclosed in an aluminium dust-proof case; the motor pinion drives a differential on a countershaft, the pinions on the end of which engage with internal rim gears on the driving wheels.

The driver operates the steering lever with his right, and the controller handle with his left hand, while standing on a projecting platform.

The latter is divided in halves, interlocked respectively with the control and brakes, so that when the driver gets off one side an automatic circuit-breaker in the main circuit opens, and when he leaves the other the brakes are applied. An upward movement of the controller handle causes forward motion, and a downward movement the reverse. Trucks are supplied with driving platforms at each end, the controls being interlocked. The speed of the truck loaded is 5 or 6 miles an hour; the turning radius of the outside wheels 12 ft. and it measures 12 ft. 5 in. × 3 ft. 9 in. over the body, weighing 2,780 lb. empty.

G.V. Electric Motor Vans.

For some months Messrs. Hay's Wharf Cartage Co., Ltd., have been using 2-ton G.V. electric motor vans for delivering meat from Smithfield Market to various firms in the London area and outlying districts, including Redhill, Kingston, Harrow, Enfield, Dartford, &c. It will be noticed that the vans, of which six are now in use, are regularly running on hilly country roads—the utility of the electric on well paved city streets is beyond question—and giving every satisfaction, so much so that a third repeat order has been given to the General Vehicle Co., who supplied the original vans, Messrs. Hay's Wharf Cartage Co. having satisfied themselves that, compared with horse vans, the saving to be effected in two years will be sufficient to pay for the first cost.

The vans frequently run 70 miles a day, as upon their return, after having run some 40 miles (the normal distance on one charge of the battery) they receive a boosting charge, and then run another 30 miles. The drivers, who were previously employed in driving horse vans, have quickly become accustomed to their new work.

The particular vehicles referred to have a sheet-covered van body with a driver's canopy, and are mounted on a standard G.V. chassis, fitted with rubber-tired wheels and roller bearings. There are two separated foot-operated brakes.

A single totally-enclosed traction-type ball-bearing motor is fitted, capable of taking 300 per cent. overload for 20 minutes; this drives through Morse chain on to a differential countershaft and thence by roller chains to each road wheel.

G.V. 2-Ton Electric Trucks used by Hay's Wharf Cartage Co.

A 44-cell Ironclad-Exide battery is carried below the chassis, and the controller is placed under the driver's seat and operated by a handle at the side; there are four forward speeds and two reverse speeds. A three-way running switch is provided having neutral, running and charging

positions; the driver can remove the handle in the neutral position, in which and the charging position the controller is inoperative.

An ampere-hour meter is fitted which automatically trips the circuit breaker when the battery is fully charged; the meter also tells the driver the state of his battery.

We gather that the acceleration of these vehicles is excellent, and that on London roads they are running loaded at speeds of 15 to 16 miles an hour, although rated at only 12 miles an hour on the level.

INDUSTRY, SCIENCE AND FINANCE.

The announcement that a Conference of the Leaders of Industry and Science would be held at the Mansion House on March 25th, to consider the mobilisation of industry and science and the working conditions in which British industry at present operates, and to suggest a new basis at the conclusion of the war may have raised hopes that this vitally important matter was at last to receive adequate treatment. Such was not the case. With all due deference to the positions and qualifications of those gentlemen who attended the Conference, we feel sure that they would be the last to maintain that the gathering was truly representative or worthy of the vast importance of the subject under discussion. The attendance may have been affected adversely by the fact that the Royal Society and the Chemical Society had meetings on the same afternoon, and it is peculiarly ironical that an Institute preaching efficient organisation should be the victim of clashing engagements.

One seeks in vain in the afternoon's proceedings for any vigorous and definite proposal of policy, and the resolution carried by the Conference ". . . that it is desirable, in order to improve the working conditions in which British industry at present operates, that there should be closer co-operation between Industry, Science, and Finance," is, at this late date, unutterably feeble. Of course it is desirable that there should be closer co-operation. That has been obvious for years past, and has formed the text of innumerable sensational but barren articles and treatises during the last eight months. The whole point is first to determine how such co-operation may be secured, and then to secure it. From this point of view, the Mansion House meeting was sterile. It is, as Sir Philip Magnus remarked, too much to expect a complete constructive policy to emerge from a single afternoon's discussion, but any institute essaying to increase co-operation between industry, science, and finance, by generalising on the subject, is simply wasting the time of its members. Precise schemes are needed, and, while we bear no ill-will against the Institute of Industry and Science, or any other body organised to deal with this important matter, we feel that the whole problem of co-operation is one demanding immediate attention by individual parties.

Individual manufacturers must realise that properly trained scientific men are good investments and, as such, are entitled to adequate remuneration and proper encouragement to invent and improve machinery and processes. Individual scientists must realise that their work must conform to the requirements and conditions of industrial practice or be handed over, at the earliest opportunity, to men able, by their training and experience, so to adapt and apply it. Individual bankers must realise that Messrs. A. and B.'s new works, new machine or new process is, subject to the judgment of a commercial scientist, whose mind does not live in a test-tube, a fit and proper security on which to advance capital for its development. It is no use talking about the matter as a general proposition. It is a subject for immediate *action*. Messrs. A. and B. can afford to pay salaries such as will bring them men with scientific qualifications and commercial and industrial experience fitting them to develop processes and plant on which Messrs. C., the bankers, can safely advance capital. But Messrs. A. and B. must not regard their scientific men as interesting freaks, commercially lunatic, to be snubbed as often as possible and placed entirely under the control of a commercial board of directors.

With Sir Philip Magnus, we agree that our output of science, our standard of technical education and our industry and inventive genius are as great as those of the world in general and of Germany in particular. With Colonel C. E. Cassel, we agree that the present position of scientists in industrial concerns in this country is ineffective and degrading. We must imitate Germany to the extent of securing the best scientific advice obtainable and giving it proper weight and influence in our industrial councils. Faults in the past and present composition and working of individual firms must be fearlessly laid bare and ruthlessly uprooted.

The reason for these urgent words and drastic proposals is not far to seek. During the war, we have industrially a breathing space—so far as concerns German competition. Great and urgent as are our industrial problems in other directions, we must find time now to frame individually—since it seems hopeless to expect any adequate general solution—the measures by which we are to conduct the coming industrial war. Once the sword is sheathed, the industrial ability and organisation of Germany will be directed to underselling in every market. The indemnity imposed by the Allies will compel great wage reductions in Germany, and the over-extended factories of that country will literally flood the world with cheap German goods. Nor shall we be immune from severe competition by our allies and by neutrals—chief among them America. To meet the unprecedented conditions which must surely arise and to avert what can only be lasting industrial ruin, we must cheapen production. As Lord Portsmouth took care to emphasise, this cannot be done in the United Kingdom by wage reductions. We shall have to increase our efficiency of production, which means utilising existing and new scientific methods to the greatest possible advantage—again a matter for immediate and sustained individual effort in individual cases. Organisation of sales and commercial methods in general is a closely allied but still distinct problem.

During the past century the development of science has exerted an ever-increasing influence on political economy, but, though we agree with Mr. J. Taylor Peddie that this has rendered unsound many of the theories formerly held by political economists and has practically given any and every industry to that country which prosecutes its development most scientifically, though we agree that the direct and reflex influences of inventions and improved methods and equipment are far-reaching, and have done more to further the progress of human development than any political measure, yet we feel that Mr. Peddie underrates the value of the assistance which can be given to science and industry, separately and conjoined, by judicious legislation and State finance. Extraordinary as the organisation of German firms has been, technologically and commercially, German industry could never have reached its present development without the diplomatic, legislative and financial assistance accorded to it by the German State. In these directions, we feel that it is up to our own Government to do many things which it has failed to do in the past, but the necessary machinery will take long to construct and bring up to speed. Meanwhile, the problem must be tackled and largely overcome by individual private effort. Until such effort has been made extensively and effectively, pressure can hardly be exerted on the Government, and definite schemes and policies can hardly be formulated with advantage by private associations.

Electrically-Driven Barges.—Our contemporary, the *Motor Ship and Motor Boat*, recently described a type of electrically propelled barge, of which about 100 are in service in one part of Germany, engaged in carrying bricks and limestone into Berlin. They are long shallow craft, built of steel, having a displacement of 250 tons and a draught under 5 ft. Their length is about 123 ft., beam 14 ft. 6 in., and depth 6 ft. A battery of 80 cells, with a capacity of 700 ampere-hours, each cell weighing 120 kg., is installed in a ventilated lead-lined chamber 10 ft. × 14 ft. × 5 ft., near the stern, and supplies energy to an 8-H.P. motor driving the propeller direct at speeds of 120 to 150 R.P.M. The speed of the barges is very low, not exceeding 3 miles an hour; they run trips in normal operation of about 70 miles, and are stated to have given satisfactory results.

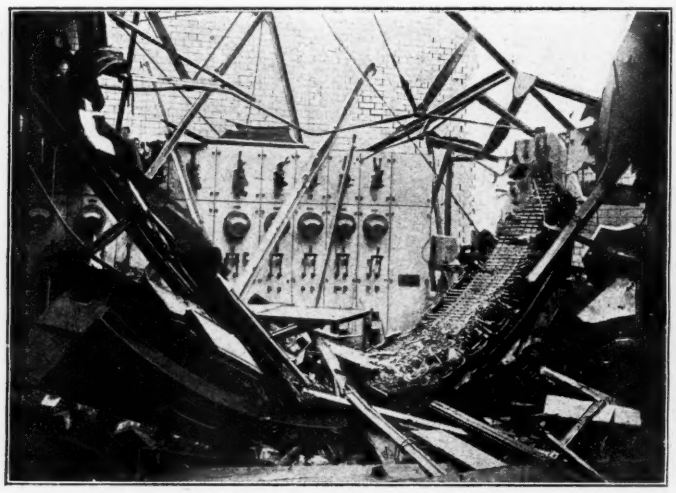
THE CARDIFF ACCIDENT.

In our issue of March 26th last, p. 434, we referred briefly to the extraordinary accident which occurred on Sunday, March 21st, at the Roath electric power station of the Cardiff Corporation, and resulted in damage estimated at some £20,000, as well as the shutting down of the tramway service and dislocation of electricity supply in the city. We are now able to publish some views taken in the station after the accident, which will convey a better impression to our central station readers of the state of affairs then existing, than any amount of description. Some idea of the position, however, was conveyed in the report of Mr. Arthur Ellis, the city electrical engineer, at an emergency meeting of his Committee, held soon after the accident, when he is reported to have stated, amongst other things, that :—

The most urgent need of the moment was to give temporary cover to the machinery, which was now exposed to the weather. The position was that one of the large engines had been entirely wrecked, and in his opinion it would not pay the Committee to re-erect or re-construct it, because, nowadays, with a modern type of plant, they would probably get a turbine at considerably less cost than they would have to pay for the re-erection of the wrecked engine. He had never heard or known of anything of the kind happening in any electric power station in the country before. He had no doubt in his mind that the engine accelerated to enormous speed, and the flywheel, of a deadweight of over 70 tons, with an electric generator of about the same weight coupled to it, burst and simply shattered the end wall and demolished most of the roof It also damaged the engine immediately opposite to it, but the damage to that was not so extensive. The greatest difficulty had been with the large 20-in. water pipes serving the new machinery. These had been broken, and the water rushing down the centre of the engine-room, together with the force of the bursting of the flywheel, had affected the foundations of the engine very seriously. Large masses of concrete had been loosened and broken up. It was found that the waterworks department had new pipes in stock. He was hoping that the concrete would have been removed in order to put the new pipes in, but there were many tons of solid concrete to be dealt with, and the task had been greater than anticipated. It was possible that it would be all removed by that evening, after which the new circulating pipes would be put in and the new plant in the power station could then be put in commission.

Whilst the accident itself was extraordinary, the escape from loss of life was more extraordinary still. One could see pieces of metal, weighing as much as 30 cwt., all over the place.

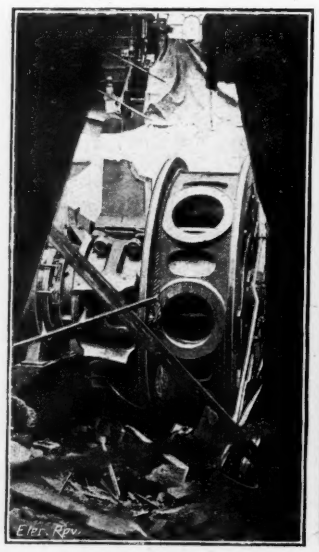
The cause of the accident was now quite unascertainable, and he did not think they would ever know the reason for it.



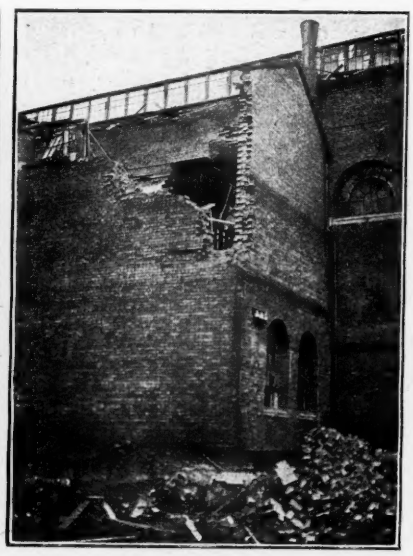
Section of Stator which Fell into Switchroom.

The Damaged Engine Room.

Accident at Cardiff Power Station.



Flywheel Boss and Remains of Rotor.



Damaged Building Containing H.T. Switchgear.

AERIAL WIRE ROPEWAY FOR AUTOMATIC DISPOSAL OF ASHES.

Some years ago we published particulars of an aerial wire ropeway at the Neepsend electricity works of the Sheffield Corporation, installed by Messrs. R. White & Sons, of Widnes, for the automatic disposal of ashes from the boiler house. It will be remembered that the ropeway in this case served a dual purpose. In the first place, it automatically disposed of the ashes, and secondly, these ashes were used to fill up part of a ravine, and make it level with the railway line on the top side of the works, and so provide extra coal storage space, and room for extra railway sidings. This work has now been completed, and in order to find further tipping ground it has been necessary to erect a fresh ropeway across the railway line, and to tip the ashes on some waste land on the east side of the railway. This involved the raising of the ashes to a sufficient height to allow the ropeway to be carried well over the railway, and leave room for a protective bridge over the railway itself.

The level of the boiler floor at this point is about 50 ft. below the level of the line, and it was therefore necessary to provide two electric hoists with a total lifting height of 110 ft., allowing ample head room.

The ashes are loaded directly from the boiler furnaces into the tipping wagons, each wagon holding $\frac{3}{4}$ cb. yard, and

are then run by hand to the foot of the electric hoist. The man in charge turns an electric switch, and the wagon with its contents is at once raised to the top. At this point the wagon engages a bar fixed in such a way that the hoist not only stops automatically, but the wagon at the same time is automatically tipped into a storage hopper immediately below it, shown in the adjoining view. The man at the bottom then turns the switch again, and the empty wagon descends with the hoist. It will be noticed that the whole of this arrangement is automatic, and it is not necessary for the attendant to travel with the loaded wagon. The hoist is supplied in duplicate, and is driven by electric motors, with counterbalance weights in the usual way.

Fig. 1.—Side View of Loading, Driving and Tension Terminal of Ropeway, with Electric Hoists, Storage Hopper and Steel Staging.

The hopper at the top is capable of holding 10 tons of these ashes, and when it is full the man in charge proceeds to empty it by the use of the aerial ropeway. Fig. 2 shows one of the carrier boxes which has just been loaded with ashes from the hopper.

It will be noticed in the views that the ropeway makes two vertical angles *en route*, and one horizontal angle. In order to comply with the railway company's requirements, it was necessary to run the line of the carrying rope horizontally, so as to keep the carriers, both loaded and empty, well within the sides of the protective bridge already mentioned. As soon as the ropeway leaves the railway it at once rises up a gradient of 1 in 3, until it arrives at the angle standard, which is 60 ft. high from the ground level, with an angle of 145°, as shown in figs. 3 and 4, in order to provide plenty of tipping height. The carriers, whether loaded or empty, pass through this angle station quite automatically, both on the forward and return journey.

From here, the carriers proceed directly over the tipping ground, where they are discharged automatically in the manner shown in fig. 3. Proceeding onwards, they are conveyed to the far end of the line, where there is an automatic return

Fig. 2.—Loading a Carrier Box from the Storage Hopper.

Fig. 3.—Return Terminal of Ropeway, and Carrier discharging Ashes.

terminal fixed at a total height of 50 ft. above the ground level, as shown in fig. 3.

The ropeway is erected on the side of a ravine, and in addition to the very high tipping space provided by the standards themselves, there is room for a very large quantity of material, due to the peculiar formation of the ground at this point, and it is estimated that the ropeway in its present position, although only 600 ft. long overall, will provide tipping space for about 53,000 cb. yards of ashes. By means of Messrs. White's special arrangement of dummy standards this space can eventually be increased to about 200,000 cb. yards.

It is understood of course, that the tipping, as in the previous installation, is done entirely automatically, as is clearly shown in fig. 3, and the carriers not only go round the return terminal automatically, but also through the angle station, so that as a matter of fact the carriers are not touched by hand from the time they leave the loading berth until they arrive there again on the opposite side of the ropeway, where they are automatically released from the hauling rope and stand on the fixed run rail ready to load again.

The ropeway is designed for carrying 10 tons per hour, but this can be increased if necessary by merely adding extra buckets. It is driven by a motor of 6 B.H.P., of the protected type, fed with two-phase alternating current at 200 volts, 50 periods, and provided with an auto-transformer starter. The electric hoists are driven by means of similar electric motors of 12 B.H.P. each, with wound rotors, and controllers of the reversible type.

Fig. 4.—Bridge over Railway, and Automatic Angle Standard.

Messrs. Gilbert Heathcote & Co., of London, provided the bridge over the railway; the whole of the remainder of the installation, including the electric hoists, was provided by Messrs. R. White & Sons, of Widnes.

The installation is a very interesting piece of work, and we congratulate Mr. Fedden, manager of the electricity department, on the satisfactory results attained.

LEGAL.

The Return of Electrical Goods.

In the City of London Court on Friday, March 26th, before Mr. Registrar Wild, a claim was made by Otto Bohndel (sole proprietor of Schoen Bros.), 29, Cock Lane, against the Wirthy Incandescent Light Co., electricians, 200, Portobello Road, Notting Hill, for the balance of account for electrical goods supplied in the way of trade.

The Plaintiffs' representative said that the claim arose from the fact that the defendants had returned goods which the plaintiffs could not accept. The goods were delivered in June, 1912, and the defendants returned them in July, 1914. Of course the plaintiffs could not accept back goods which had been kept for over two years.

The Defendant said the statement was not true. The arrangement made with the plaintiffs' traveller was that all faulty goods should be returned, and that was what had been returned. As, however, the defendants had stopped dealing with the plaintiffs, they had refused to change the last lot of goods.

The Registrar: It is said that the goods returned were delivered in 1912.

The Defendant: No; they were not.

The Plaintiffs' Representative: I can prove it.

The Defendant said there was one line, amounting to 1s. 7½d., delivered in 1912. The rest of the goods returned were delivered in January, 1914, and were returned in July.

The Plaintiffs' representative said their agreement was that no goods could be returned after six months.

The Defendant said the plaintiffs had always changed goods previously, and had never stipulated that it should be done in six months.

The Registrar intimated that if the defendants ordered goods of the plaintiffs upon ordinary sale or return terms, kept the goods for six months, and then returned them, in his (the Registrar's) opinion, that was a great deal too long to keep them, unless it was shown that there was a contract between the parties to that effect, or that it was well known in the trade that goods could be kept for six or seven months before returning them.

The Defendant said he could only prove his arrangement by previous transactions, and he had not brought the necessary papers with him to do that.

The Registrar suggested that the defendants' point might be brought out by questions asked of the plaintiffs' witness, but the plaintiffs' representative said they would not exchange any goods after six months.

Continuing, the Witness said when the defendant returned the goods plaintiffs went through them carefully and exchanged part of them. Others they could not accept, having been too long delivered.

The Defendant said the arrangement made with the plaintiffs' traveller was that they could exchange batteries and lamps after six months.

Plaintiffs' representative said no such agreement was ever made with the defendants. They could not do it.

The Defendant stated that his dealings with the plaintiffs were through their traveller, who had said the firm was very fair in its dealings.

In answer to the Registrar, it was stated that the goods in question were of German make, and the Plaintiffs' representative remarked "about the best ever supplied in the trade."

The Defendant: We thought we could not get a British article better than the German. We did not know it until now.

The Registrar pointed out that a part of the case that seemed to strike him was that some of the goods might have become faulty while in the defendant's possession.

The Defendant: That was the reason for the guarantee being given. Further, he said he had kept batteries in stock for 12 months and the plaintiffs had exchanged them and had said nothing against it until now.

The Registrar said if the defendant could prove that the plaintiffs had accepted back goods under circumstances such as he alleged, there might be something in his case. It was denied by the plaintiffs, and the defendant's contention seemed unreasonable to him (the Registrar).

The Defendant, in answer to questions by the Registrar, said there was nothing to prevent him testing batteries. He did not send back one or two batteries at a time, but at the suggestion of the traveller had kept them until he had a number of faulty articles to return.

The Registrar thought there was something in the defendant's suggestion as to keeping some of the goods over time, while wait-

ing to return others in time, and ordered the case to be adjourned for the plaintiffs' traveller to attend. The Defendant should also bring his documents to prove that he had returned goods to the plaintiffs as he alleged.

On Tuesday, March 30th, the defendant produced two credit notes in respect of goods which he had returned and which he said had been kept as long as the returned goods over which the dispute now arose.

The Registrar said he should require to see the invoices under which the goods, in respect of which the credit notes were given, were supplied. Without seeing such documents he (the Registrar) could not judge whether the goods had been returned within a reasonable time or not.

The Defendant said he did not think about bringing the invoices within him.

The Registrar said he saw that the credit notes were dated September 13th, 1912, and February, 1913, but the goods might have been invoiced the day before. The defendant wanted to prove that notwithstanding that a period of six months had elapsed it was a custom in the trade in his dealings with the plaintiff that he would accept the return of goods after such a period. The adjournment had been given for the defendant to prove his assertion. He (the Registrar) was afraid he could not help the defendant.

The Defendant said he thought the credit notes would be sufficient for his purpose.

The Registrar said the credit notes were only evidence that goods were returned upon certain dates, but they did not state how long the goods had been kept, and the plaintiffs complained that the defendants had kept the goods far too long.

The Defendant said he had kept back some batteries which were faulty, at the express request of the plaintiffs' traveller.

The plaintiffs' traveller, Ames, denied that he had requested the defendant to keep back batteries (dry cells); they were to be sent back immediately.

The Defendant said that that was a perfect lie.

The Registrar said that the defendant did not give him an opportunity of judging whether there had been such a customary dealing as he alleged. Therefore the case came back to the question whether it was reasonable for the defendant to have kept the goods as long as he had. The goods now in question had been kept at least seven months. The defendant had not proved his custom, and the plaintiff would have judgment for the amount claimed, without costs.

The Prize Court.—Seizure of Electrical Fans.

In the Prize Court on March 30th the President, Sir Samuel Evans, had before him a suit by the Crown asking for the condemnation as enemy property of five cases of electric fans, seized on board the P. & O. steamship *Poona*, in London on October 17th. The goods were claimed by Isaria, Ltd., a company duly incorporated in England.

Mr. J. B. Aspinall, for the Crown, said that the fans were sent to Germany at some time before the outbreak of war by Isaria Zahlerwerke, of Munich. The outer wooden case in which the goods were packed bore labels printed in Germany, and also had the words "made in Germany" stencilled upon them, and each of the fans was wrapped in paper bearing printed German labels. They were forwarded to Australia by the steamship *Rheinland*, but were afterwards sent back to this country to Isaria, Ltd., a company duly incorporated in England.

The President: When did they reach Australia?

Mr. Aspinall: Before the outbreak of war. They were sent back to this country on the ss. *Poona*, consigned by Messrs. Lascelles, Parrington & Brasche, of Melbourne, "to order," London.

The President: How did the firm in Melbourne get possession of the goods?

Mr. Aspinall: They were handed over to them by one Brandl, who is alleged to be the Australian traveller of the English company, but who I shall ask your Lordship to say was the Australian traveller of the German company. I submit that these goods were so tinged with German interest that they ought to be condemned. The contention on the other side is that the goods are the property of the English registered company. Counsel quoted the following passage from the judgment of his Lordship in case of "The Tommi and Rothersand," with reference to the question of an English company consisting entirely of aliens. "These technicalities have not been allowed to bind decisions in the Prize Court. They have been treated rather as gossamer to be brushed aside, and the Prize Court rather regards the essential qualities of any transaction and tries to arrive at the realities of the case. . . . It no doubt is the case that a company registered in this country under the Companies' Acts is a separate entity, and such a company can own a ship. Whether a company consisting entirely of aliens can own a British ship is a question which probably has never arisen, and has never, therefore, been decided. I am not sitting here dealing with maritime law, and, therefore, I am not called upon to decide that question, but I do not want it to be assumed that the Prize Court could not say, looking at the realities of this thing, that even if the transfer has been completed, and if the shareholders in the British company became the purchasers, this vessel ought to be regarded as a German ship."

The President: That was before the decision of the Court of Appeal in the Continental Tire and Rubber Co.'s case.

Mr. Aspinall agreed. In that case it was held, Lord Justice Buckley dissenting, that an action of debt was maintainable by an English company of which all the directors and shareholders were alien enemies. Lord Justice Buckley's dissenting judgment, however, was of very great force and strength, and Lord Lindley, in a letter to the *Times*, agreed with him.

Mr. Aspinall called attention to an affidavit by Mr. Frank Morton, manager of Isaria, Ltd., of 208, Tower Bridge Road, from which it appeared that the company were merchants, and dealt in electrical appliances, including electrical fans. The great majority of the shares were held by the German company. Four directors of that company and another person, all resident in Germany, held one share each, while another share was held by a Frenchman.

In reply to the President,

Mr. Aspinall said that looking at the reality of the transaction his case was that the goods were probably the property of the German company. But even if they were not, but were the property of the English company, then he contended for the purpose of prize, that that company was so German that if the goods belonged to them they ought still to be condemned. He asked his Lordship to follow up what he said in "The Tommi and Rothersand case," and look at the "realities of the thing." He submitted that apart from the decision of the Court of Appeal his Lordship sitting in prize with a discretion and with an ability to look through the transaction, would do justice to the British Crown. He invited the President to consider very seriously whether looking through the fog of the class of affidavit put forward in this case, he could not see the light and the real truth of the matter, and to use his Lordship's own expression brush aside the gossamer.

The President: Perhaps that expression was a little too strong.

Mr. Aspinall: I think it was an expression extremely apt for the purpose of that case, and very suitable for my argument.

Mr. Elkin, for the claimants, said his submission was that where the goods were shipped and seized in a British ship trading between two British ports, the onus was on the Crown to prove that the goods were of an enemy character.

The President: No.

Mr. Elkin said that then he submitted that the goods were clearly the property of the English company, and as such were not confiscable. The transaction was a simple one. The goods were ordered from the Munich company by the British company, and were sent direct to Brandl, the British company's Australian traveller, and he handed them over to the British company's Australian agents, Messrs. Lascelles, Parrington & Brasche, on sale or return terms. The goods proved not to be suitable for the Australian market, and the agents shipped them back to London. At the time of seizure they were the property of the English company.

Mr. Frank Morton, the English company's manager since August 3rd, gave evidence to the effect that the goods were bought outright by the English company from the German company, and had been paid for by running account.

In a letter which Messrs. Lascelles, Parrington & Brasche wrote in September, when forwarding the bill of lading in respect of the goods to the English company, this passage occurred:—"There has been some delay in connection with the matter owing to the war, as it was Mr. Brandl's intention to attend to the business, but he has been naturally very unsettled, and as the bill of lading is no good to us, the best thing to do is to let you have it, and trust that you will be able to obtain possession of the goods."

The hearing was adjourned till Tuesday, April 13th, for further evidence.

Costelloe *v.* Universal Radio Syndicate, Ltd.

At Listowel (County Kerry) Quarter Sessions last week, before County Court Judge Dromgoole, John Costelloe, formerly an employé at the wireless telegraph station at Ballybunnion, County Cork, sued the Universal Radio Syndicate, Ltd., in liquidation, for damages for injuries sustained whilst in their employment.

The Plaintiff, in his evidence, stated that for about 10 months he had been employed at Ballybunnion wireless station, owned by the syndicate. On January 18th last he received notification from the manager to the effect that his services would not be required after Saturday, January 23rd. In accordance with the usual custom, he was paid, with the other employés, about noon on January 23rd, but was not to leave work until 5 o'clock that evening. He came back from dinner at 1 o'clock, and together with four other employés went, at about 2.30 o'clock, up the pole or tower of the wireless station, which is about 490 ft. high. They went up from the inside for the purpose of fixing steps. Their directions were that whenever the weather permitted they were to ascend the tower and fix on the steps. The morning of January 23rd last had been very wild, and when the weather cleared up at 2.30 o'clock, they ascended in accordance with the instructions received. At about 4.15 o'clock, after fixing on about 18 steps, they decided to go down again as the evening was getting dark, and when at a distance of about 40 ft. from the ground plaintiff lost his hold and fell to the ground—a concrete foundation. He received injuries to the head, neck, legs and sides, and, as a result, was under the treatment of Dr. J. Costello for about eight or ten days. Although no bones were broken plaintiff still felt very sore, and was unable to work.

The evidence was corroborated by the other men who were working with the plaintiff.

Mr. C. T. Elwell, manager for the syndicate for the defence, said the men had no authority to ascend the tower on that occasion.

His Honour held that the plaintiff was in the employment of the syndicate at the time of the accident, and granted plaintiff a decree for £5 and costs.

HERBERT MORRIS, LTD., *v.* SAXELBY.

THE Court of Appeal, composed of the Master of the Rolls, Lord Justice Phillimore, and Mr. Justice Joyce, on March 31st, delivered judgment in this case upon the plaintiffs' appeal from a judgment of Mr. Justice Sargant.

The proceedings in the lower Courts have already been fully reported in our pages.

The MASTER OF THE ROLLS held that the covenant was unreasonable and was an unusual one in the engineering trade. He could not, he said, think it was reasonable to require the defendant to put aside all the skill and experience he had acquired during 10 years, and to practically begin life afresh. There was no suggestion that the defendant had been guilty of any breach of confidence or that he had disclosed, or threatened to disclose, any secrets of the plaintiff company. He thought the decision of Mr. Justice Sargant was correct.

LORD JUSTICE PHILLIMORE dissented, being of opinion that the covenant in the modified form, to which the plaintiffs agreed, was not too wide. He thought, therefore, that the appeal ought to be allowed.

MR. JUSTICE JOYCE agreed with the judgment of the Master of the Rolls, and the appeal, therefore, by the majority of the Court, was dismissed, with costs.

LIGHTING SUMMONSES.

AT the Manchester Police Court on Thursday last week the Stipendiary Magistrate fined two shopkeepers trading in a main thoroughfare £1 apiece for having too brilliant a light in their shop windows after having being cautioned. These were stated to be the first cases in Manchester under the Defence of the Realm Act lighting restriction order.

ELECTRICAL SUPPLY TRADE IN SOUTH AMERICA.

THE following are extracts from certain reports which have been received by the American Government from its Consular representatives in South America as a result of the general inquiry referred to in a leaderette in a recent issue of the ELECTRICAL REVIEW, as having been made in oversea countries with a view to the possible expansion of American trade in electrical goods; the reports are not being published in full, but are being reserved for inspection by American manufacturers.

ARGENTINA (ROSARIO).—Argentina offers a growing market for electrical supplies of all kinds. The total imports of such goods increased steadily from about £643,000 in 1908 to about £1,951,000 in 1913; and while the figures for 1914 will undoubtedly show a falling off, this can be ascribed to temporary causes—financial depression, in the first place, and the interruption of trade with Continental Europe.

Electricity is extensively used in all the leading centres of population and is gradually entering the smaller country towns, many of which are already electrically lighted. The industrial census of 1910 showed that in that year, or somewhat earlier, 21,790 electrical horse-power were used in Argentine industrial establishments, and the census taken last June will undoubtedly reveal a great increase in this direction. Opportunities for the utilisation of water power in the Andes and other mountain regions, as well as the current of the Uruguay River between Hervidero and Santo Tome, will give an additional impulse to the use of electricity for light and power. It is safe to say that the demand for electrical supplies will increase steadily in Argentina; on the other hand, it will be a long time before foreign firms will have to meet serious home competition in this field.

Official statistics of imports give to Germany the leading position for practically all kinds of electrical supplies. The United Kingdom is the chief source of a few lines, particularly certain grades of wire, commutators, vulcanised fibre, telephone and telegraph supplies (imported largely by British companies operating in Argentina), batteries, &c. The United States led in 1912 (the latest year for which detailed figures are available) in only two lines, namely, small motors (called "motorcitos"), of the type used for driving electric fans, &c., and wall sockets.

The failure of American manufacturers to obtain a larger share of the trade in electrical goods is generally attributed to the fact that German products are lower in price and German firms more liberal in the matter of terms. Another factor is undoubtedly to be found in the absence of large consumers of electrical supplies operating with American capital and interested in the extension of American trade. European concerns controlling Argentine railways, tramways, power plants, electric-light companies, telephones, &c., are in some instances directly interested in the manufacture and sale of electrical supplies. The importance of this will be seen when it is stated that in 1912 electrical supplies, valued at about £225,000, were entered free of duty; that is, by railways and other public utilities enjoying the privilege of free entry.

Several leading European and American manufacturers of electrical materials are represented at Buenos Ayres either by agents or by branches. The present tendency appears to be to establish branches. As regards Rosario, one of the large German factories has a branch here, and an electrical concern with factories in several countries is represented by the Rosario branch of its Buenos Ayres agents. Other concerns represented at Buenos Ayres are in close touch with the Rosario market, most of them selling to local dealers without distinction.

Some of the large general importers of hardware and machinery at Rosario maintain an electrical section, import electrical supplies, and install lighting systems, small power plants, &c. There does not seem to be much inclination on the part of these large hardware and machinery jobbers to extend this branch of their business; in fact, it appears from information obtained recently that some of these firms intend to give up their electrical sections, as the active competition of a host of small electricians, largely Italian, has reduced profits on electrical work to a minimum. The tendency is rather for the leading manufacturers to establish branches at Buenos Ayres, which will presumably be followed later by supplies at Rosario, which deal direct with the electricians and dealers. This does not, of course, mean that some of the Rosario jobbers, importing direct or buying from Buenos Ayres branches, do not continue to do an important business. It is evident that with leading manufacturers represented at Buenos Ayres it is difficult for firms, without good connections in Argentina, to get any important share of the trade. As already stated, difference in price and readiness to grant credit have thus far given German manufacturers a considerable advantage. As long as the war lasts Germany will experience difficulty in supplying the local market, but American manufacturers are reminded that the United Kingdom already does a much larger business in electrical supplies with Argentina than does the United States, and that Italy is only a short distance behind. The Sociedad de Electricidad de Rosario (light and power plant), in an effort to increase the consumption of current at Rosario, particularly during those hours when consumption is ordinarily smallest, has rented a large store on one of the principal business streets, and has there installed electric fans, drying apparatus, toasters, irons, table and cooking utensils, stoves, motors for sewing machines, &c. While the company does not seek to sell apparatus or appliances, it may eventually carry a small stock of articles that local firms do not handle. When business picks up again the activities of the Sociedad de Electricidad may be expected to lead to an increased demand for electric appliances and supplies at Rosario.

BRAZIL (PERNAMBUCO).—Considering its population of some 250,000, Pernambuco's present demand for electrical supplies is small, but as soon as the plant now nearing completion is ready to furnish current to the city—which will be about May 1st—an opportunity will be presented for the introduction of electrical materials of all kinds. Manufacturers and exporters of such goods are advised to begin immediately to study the conditions on the market and to make satisfactory business connections with a view to extending their trade later in this district, inasmuch as Pernambuco is the distributing point for many small cities, some of which already have electric lighting and power stations, and others are now arranging for the installation of such plants. Olinda, a suburb of Pernambuco, but having a separate municipal Government, has its own lighting plant. It has been reported that a concession for an electric lighting and power plant at Goganna, a city of about 15,000 inhabitants, some 50 miles north of Pernambuco, has been granted to a Brazilian company, which contemplates erecting a 200-KW. station and also a 100-KW. auxiliary hydroelectric plant. Maceio, the capital of the adjoining state of Alagoas, Parahyba, the capital of the State of the same name north of Pernambuco, and Natal, the capital of Rio Grand do Norte, have electric lighting and street railway systems.

COLUMBIA (CARTAGENA).—Electric stoves have not come into use as yet in the Cartagena Consular district. The old-fashioned Spanish clay stove, burning charcoal, still holds first place. Electric stoves would prove far too expensive for the vast majority of families in this section. Further, the electric light and power company furnishes current during the night only; a uniform charge of $1.50 per month for one 16-C.P. light is made. There is no meter system. There has been some discussion regarding the installation of a larger and more modern plant, but no definite steps have been taken, and it is probable that nothing can be done until commercial conditions improve considerably.

VENEZUELA (MARACAIBO).—Electricity for lighting purposes is now in general use throughout the larger towns of the Maracaibo district, but the fact that power is supplied only at night effectively eliminates a trade in electrical household articles, such as irons, stoves, vacuum cleaners, and washers. Beauty in lighting is not striven for; there is scarcely any attempt to conceal the wiring, and the call for electroliers is slight. Electrical signs and advertisements are unknown here. Wire and wiring materials are imported direct by the companies supplying the power; hardware firms handle a small number of portable lights, electroliers, telephones, &c.

Electrical Trades Benevolent Institution.—At the annual general meeting that is, as already announced, to be held at the Institution of Electrical Engineers, Victoria Embankment, W.C., on Monday, April 19th, at 6.30 p.m., the report and accounts for 1914 will be submitted, and the following members of the Committee of Management, who retire by rotation, will be eligible for re-election:—Messrs. E. J. Clark, Guy Burney, H. Bevis, H. H. Berry, Lt.-Col. H. M. Leaf, Lord Vaux of Harrowden, F. J. Walker, R. J. Wallis-Jones, and S. D. White.

WAR ITEMS.

Trade with Italy.—The present war will no doubt be the cause of a considerable set-back to German trade in Italy, but it will only be temporary unless United Kingdom firms awake to the fact that more practical and up-to-date methods must be adopted for cultivating the Italian market. Since the last years of the nineteenth century, German trade with Italy has increased proportionally by leaps and bounds. This is the result of perseverance and adaptation, not of chance, and British firms interested in the Italian market should bear in mind the following points to which German export commerce owes a great deal of its success, viz.:—

Representation.—The German trader cultivates his market either by personal visits or else by means of well-trained commercial travellers speaking fluent Italian, whereby personal contact with customers is established. On the other hand many British traders conduct their business in Italy by correspondence with agents they have never seen.

Quotations.—The German trader invariably quotes in Italian currency or in French gold, and in metric weights and measures, preparing his catalogues and price-lists accordingly, whereas his British competitor usually seriously handicaps himself by quoting in £ s. d. and in British weights and measures, so that calculation and comparison are extremely difficult for the Italian buyer.

Delivery.—Most German traders will deliver "franco domicile," thus saving customers the trouble of calculating freight, duty, carriage, etc. Or his quotations are at least given c.i.f. port of disembarkation, whereas British offers are still often merely made f.o.b. British port.

Credit.—Thanks to his system of personal contact with customers, the German trader is in a position to judge what credit may safely be granted, and is thus generally able to give much easier terms of payment than his British competitor. In spite of the long credits often conceded, it is said that the Germans very seldom made bad debts.

Trade Grouping.—The system in vogue in Germany of grouping several large firms together to work in conjunction, no doubt had the effect of assisting German penetration. If an extensive and complicated industrial plant is required, it is difficult to find a British firm to supply all the different parts, and still more difficult to find that the various units combine in such a way as to make a perfect whole. Most British firms are specialists, and in order to favour British contractors, it is necessary to sub-divide contracts, giving rise to difficulties, besides the trouble the customer has in treating with several contractors.

The majority of solid people in Italy would prefer to do business with the United Kingdom if only things were made easier for them. The British manufacturer should therefore be much more painstaking as regards the Italian market, and advantage should be immediately taken of the present conjuncture to establish a firm footing, for otherwise it is to be feared that, after the war, Germany will rapidly make good the ground she now seems to be losing. Discouragement should not be felt if profitable business does not immediately ensue; close quotations. reasonable credit terms, perseverance and adaptability, will be required, and with regard to the language, if it is not possible to use Italian, French will be found very useful. Representatives of British firms travelling Italy will be afforded assistance at the various offices of this Chamber, especially with regard to suitable agents, likely buyers, interpreters, etc. The Chamber is prepared to receive and exhibit in its Genoa offices, free of charge, any small samples or catalogues of British merchandise that may be sent to it; catalogues should be sent by book-post, small samples as "samples, no value," but registered.—"Bulletin of the British Chamber of Commerce for Italy."

Science in Industry.—Sir William Lever, presiding recently at the annual meeting of the London Commercial Travellers' Association, said that they heard a good deal about capturing German trade. As reported in the "Financial Times," Sir William Lever said that when they talked in a narrow way of antagonism with the enemies of their country they must not let the war obscure their view of the fact that countries were dependent upon each other in regard to commerce. We had in this country the finest material and all the attributes which made for leadership and for maintaining the initiative, but we had allowed them to slip behind. The technical training which our youths required to fit them for the highest positions in the scientific conduct of business had been neglected. If we were to capture German trade, it could only be done on the basis of the application of greater scientific training in general. They must have a better article to show. If we concentrated on more scientific attainments and found our business outlook enlarged, that would be one of the many useful lessons of this war.

A Melbourne Contract.—According to a report in the "Melbourne Age," for February 10th, at a meeting of the City Council Coun. Cabena, chairman of the Electric Supply Committee, submitted a report on the tenders which had been received for the supply of a 5,000 kw. turbo alternator for the city power house. He stated that about sixty tenders had been received, the most favourable being that from the British Westinghouse Electrical and Manufacturing Co., of £15,111 for the plant, and £1,015 for spare parts. In accordance with a previous resolution of the Council, the Finance Committee had asked for a statement from the company as to whether any German or Austrian material, manufacture, or capital, would be employed in supplying the plant. The Committee had received a sworn affidavit from the Melbourne manager of the firm stating that out of 2,432 shareholders in the company, representing a capital of £1,150,000, there were only five persons whose names appeared to be German or Austrian, and these only held shares to the amount of a little over £2,000. "I believe," said Coun. Cabena, "that it would be practically impossible to get any large concern that is nearer to being an all-British company." Coun. Davey said he agreed with the remark of Coun. Cabena that it was very difficult to get any large company without a small amount of German capital. But were they going to discriminate between a small amount and a large amount? He did not think the case was any worse or better than the case of Siemens Brothers. As they did not exclude consideration of Siemens Brothers' tender, he certainly supported the recommendation, which was unanimously adopted.

Sydney Contracts.—It is reported in the "Sydney Morning Herald" that on February 9th, at the City Council meeting, a letter was read from the British Trade Commissioner (Mr. G. T. Milne) pointing out that, if the recommendation of the Works Committee, that no contract be entered into with a British firm unless all the shareholders were British, was carried, the interests of a number of bonâ-fide British concerns would be gravely prejudiced. Under the conditions of modern industrial finance, and owing to the international character of Stock Exchange operations, some of the shares of a company strictly British in character might be held by foreigners without in any degree modifying the company's essential character. Its capital might be wholly employed in the United Kingdom in the manufacture of goods wholly made by British workmen, and so long as the majority of the shares were held by British subjects the company should be regarded as British, not only because of its being registered in the United Kingdom, but actually. If at the outbreak of hostilities some of the shares happened to be held by, say, German subjects, this in no way affected the British character of the concern, so long as the number so held represented a minor portion of the capital. If the Council adopted the recommendation of the Works Committee it would, in his opinion, defeat the patriotic purpose and intention embodied in its previous resolution regarding British preference, and would also aid neutrals, and by doing so divert money from Imperial channels.

British Trade with Russia: A Suggestion from Petrograd.—In a letter received by us in reply to a communication addressed to the Russo-British Chamber of Commerce, 4, Gorochovaia, Petrograd, the Secretary says:—"In Russia there is a great desire to deal with British firms of high standing, and we ask you to kindly make known to your readers that any firms desirous of exporting their goods to Russia, or of appointing agents or opening branches here, can apply to this Chamber, giving references, and also send their catalogues for the Special Collection of Catalogues of the Chamber." We are sure that British manufacturers will not be slow to take advantage of this invitation.

British Trade with China.—Reuter's correspondent at Hong Kong reports that the local Hong Kong Press displays a good deal of anxiety concerning the outcome of the negotiations between Japan and China, and reflects feelings strongly held by British merchants in expressing a strong hope that an official announcement will shortly be forthcoming from the British Government demonstrating that no trade monopolies imperilling British commerce are to be apprehended.

Manufacturers and Electricity Works Extensions.—The Employers' Parliamentary Association, at a meeting held in Manchester recently under the presidency of Sir Charles Macara, adopted the following resolution:—"That this meeting is of opinion that permission should be accorded to the Manchester Corporation, and to other Corporations similarly situated, by His Majesty's Treasury, to raise fresh loans for the purpose of the extension of any electricity undertakings, as any refusal to secure permission would hamper to a very considerable extent those firms engaged on Government contracts who are dependent upon the Corporation for their supplies of motive power, and this Committee is emphatically of opinion that where it can be shown by any Corporation that the extension of electricity plant is necessary for an adequate supply of motive power on account of the additional requirements of firms engaged on Government contract work, on application by the Corporation concerned, permission to undertake such extensions ought to be granted with all possible expedition."

Board of Trade Assistance.—The Commercial Intelligence Branch of the Board of Trade has issued list No. 14 of articles which enquirers desire to purchase. This list is of inquiries received during the week ended March 27th, and contains the following:—Bakelite; electrical apparatus and accessories—bells, black vitrite for lamp caps, caps for electric incandescent lamps, electric light fittings, ignition devices and accessories, insulators (moulded and porcelain), metal cases for pocket lamps, white flame carbons (18 m.m. cored) for lamps for photographic purposes; galalith material; lighting plant; searchlights; vibrators and electric massage machines; tungsten.

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Munitions of War: Additional Labour.—With reference to the appointment of a Committee to take the necessary steps to provide additional labour for ensuring a sufficient supply of munitions of war, Mr. Herbert G. Riddle, Secretary, Society of Model and Experimental Engineers, writes to the "Standard" as follows:—"In view of the expressed opinions of the leaders of the Government as to the difficulties of manufacturing munitions of war and the acknowledged shortage of labour, the Society of Model and Experimental Engineers desires to call attention to the existence in this country of the considerable amount of mechanical ability and experience possessed by people who are not professionally occupied in engineering. No doubt many of these would be willing to offer themselves for service in Government workshops if suitable conditions of employment could be arranged. The society suggests that the Government consider the formation of an industrial branch of the Royal Engineers, in which such men might enlist without having to conform to the existing military standards. The proposal might also attract trained workers whose services are not at present being utilised for Government work."

Anglo-Russian Trade.—At the meeting of the Hull Chamber in March, Mr. Bernard Barton presiding, a letter was read from Mr. A. Bournasheff, Russian Consul at Hull, stating that the success of German imports into Russia was due to (1) the adjustment of the manufacturers to the demands of the Russian markets; (2) the extensive credit given to Russian buyers; and (3) sending goods on commission, thus keeping stocks in Russia and avoiding the necessity of ordering the same every time from abroad. He suggested further that the success of British imports would depend upon the willingness of the English manufacturers to send their goods on credit and also on commission to Russia, and he gave the name of Mr. Tcheremicinoff as the agency from whom reliable information as to credit of Russian firms could be obtained.—"Chamber of Commerce Journal."

London Electrical Engineers (T.R.E.).—On Friday, March 26th, a dinner and smoking concert was held at the Feathers Hotel, Westminster, by No. 15 Squad of this Corps. An excellent programme made the time at their disposal pass very quickly, and a notable item of the evening was the presentation of a framed photograph of the members of the Squad to the Chairman and Instructor, Sergt. W. Robinson, who responded with an appropriate speech. The members were fortunate in being honoured by the presence, as guests, of the senior N.C.O.'s of the regiment, each of whom contributed a few well-chosen remarks. The proceedings closed with a vote of thanks to the Chairman, Auld Lang Syne, and the National Anthem.

International Metal-Workers.—The "Times" states that it is now proposed to change the headquarters of the International Metal Workers' Federation from Berlin to London. The membership, according to an official statement just issued, numbers 912,707. Germany is represented by 544,000, and Great Britain by 115,000. The new president of the British section is Mr. J. T. Brownlie, of the Amalgamated Society of Engineers.

No Obstacle to Recruiting.—The Bolton Tramways Committee has authorised the manager to grant, without condition, permission to any employé who may wish to join the colours, notwithstanding that men so leaving will necessitate a reduction in service.

Personal.—The "Times" states that the Headquarters of the Mechanical Transport Column of the City of London National Guard Volunteer Corps are now at the offices of the Commercial Motor Users' Association, 83, Pall Mall, S.W., and that Colonel R. E. Crompton, C.B., has been appointed Hon. Commandant.

Mr. J. J. McMahon, electrical engineer in the overhead equipment department of the Manchester Corporation Tramways undertaking, was a passenger on the ill-fated "Aguila," which was recently torpedoed, but a message received in Manchester last week stated that he was one of a party who got safely away in a boat, and was rescued. He was taken on board the "Lady Plymouth," which proceeded to Madeira. Mr. McMahon has not been well recently, and, being one of the important officials in the service of the Manchester Corporation who had to forego his holiday last year, he decided to make a trip to the Canary Islands.

Mr. A. W. Mulliner, of the Eccles Corporation electricity department, has been gazetted a lieutenant in the King's West Surrey Regiment.

Mr. John Hodgson, until recently an accounts clerk at the Anchor Cable Works, Leigh, who enlisted as a private in the Army Service Corps in September last, has worked his way up until now he holds the position of warrant officer, although he is only 20 years of age. It is suggested that he is possibly the youngest warrant officer serving in H.M. Forces.

In a lengthy list of Aliens, to whom certificates of naturalization were granted during March, there appears the name of Morten Dahl Röer (Norway), electrical engineer, Leith.

Roll of Honour.—Private J. H. Caine, of the 1st Loyal North Lancashire Regiment, formerly employed at the Darwen electricity works, has been killed in action. He was 40 years of age, and has left a widow and two children.

Private J. Barrett (single), aged 30, formerly a Manchester Corporation car driver, has been killed in action.

Private Frederick Harkness, 1st Battalion Grenadier Guards, a former employé at the Manchester Corporation Electricity Station, Dickinson Street, was killed in action on March 10th. He served through the Boer War, and re-enlisted in his old regiment when the present war broke out. He leaves a widow and five children.

Mr. Albert Gay, borough electrical engineer, of Islington, has sent us a photograph of a Roll of Honour of the employés from the works—26 in number—who have joined the Colours. The roll, which is artistically designed, is the work of Mr. W. E. Bradshaw, the mains superintendent; the original is executed in colours.

TELEPHONE TROUBLES IN THE TROPICS.

By W. LLEWELLYN PREECE, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *on March 25th*, 1915.)

The climatic and other consequent troubles experienced give the engineer who is responsible for the maintenance of a telephone system in a tropical country more worry and anxiety in one week than his colleagues elsewhere experience in a year. The main troubles are due to the damp, and to the many natural effects caused by damp heat. In many places the humidity of the atmosphere varies between 80 and 90 per cent., and this damp heat produces a marvellous growth of vegetation, while insect life is as prolific as the vegetation, and sometimes even more trying.

Lightning has a virulence unknown here. The electrical state of the atmosphere has an effect on the human nerves which seriously disturbs one's temper. Even wild animals do their best in some places to increase the engineer's labours. For instance, in some parts it is not unusual to have a mile or two of lines wrecked by giraffes, elephants, or monkeys. The giraffes roaming over the wilds of East Africa come up against a telegraph or telephone line; they have not the sense to draw back and duck their heads under the line, but they push on and on, carrying wires and sometimes the poles with them. As similar troubles are experienced not only in telegraph systems, but also in heavy electrical installations, especially where overhead transmission lines are employed, the author hopes that this paper may be of some interest to all branches of the electrical engineering profession.

Instruments.—So far as white ants are concerned, we find that the use of teak practically prevents their ravages. A swarm of bee-like insects of Nigeria took a great fancy to use an instrument as a hive. Their entrance was the slot of the switch-hook, and the comb formed in the interior was cleared out many times, but each time it was re-formed by the insects, until in despair the engineer had the whole apparatus removed. The spider is a real pest all over the tropics; it builds for itself a nest in the telephone case, so that it is no uncommon experience to find instruments entirely *hors de combat* from the work of this insect.

To circumvent the insect plague it is essential that these telephone cases should be sealed up as closely as possible. The switch-hook should carry a brass plate which keeps the slot in which the arm works entirely covered. It is also desirable to have no terminals above the instrument, but to take the conductors through holes into the case and seal up these holes. Besides this, the internal wiring should be made as simple as possible; the wires must not be bunched together, but well stapled to the body of the instrument in separate ways. It is generally found that enamel insulation with a silk covering is very suitable, though enamel insulation does not always give satisfaction.

In a tropical climate the ebonite sheath of a receiver may become soft and pliable; this is easily remedied by using blocked brass sheaths covered with enamel. In a tropical country a lot of trouble was caused by the insulating block which carried the contact springs in a capsule transmitter of a micro-telephone being warped by the damp heat, so that both springs touched the metal case of the capsule and short-circuited the microphone.

In most of the tropics the faults in the subscribers' instruments caused by lightning are very few, and so long as the engineer takes the precaution to fix the lightning protector at the point where the wires enter the house little trouble need be feared. Where the casual custom of fixing them near the instrument is followed it is not uncommon for the building to be set on fire. Until the protectors were fitted to the eaves of the roofs outside the building walls, the telegraph offices of Northern Nigeria were repeatedly burned down through lightning.

The only other trouble likely to be experienced with the subscriber's instrument is that due to maltreatment by the subscriber himself. The tropical climate is not conducive to an equable temper. Even in this country the vagaries of the telephone cause occasional outbursts; there it is far worse. The owner of a large rubber estate complained bitterly time after time of his instrument; finally the engineer discovered that this subscriber was in the habit of using the mouthpiece of his micro-telephone, which hung from a wall-instrument by his desk, as a cigarette ash tray.

Exchange Switchboard.—Until lately the craving of the tropical engineer was to have the up-to-date central-battery system. There is, however, one obstacle in the way; the maintenance of really satisfactory insulation on overhead lines is almost impossible in the tropics, and if a pressure of 24 or 40 volts was applied to the line, even moderately fair working of the system would be extremely doubtful. The author has therefore set himself strongly against the central-battery board, unless a Government is prepared to place the whole system underground—which is usually prohibitive in cost seeing that some of the subscribers' premises are perhaps 20 miles or more from the exchange.

If this is the case with a central battery, what chance is there of satisfactorily maintaining an automatic system? Not only are we to expect insulation troubles with the high pressure on the lines, but there are also the intricate selectors and pre-selectors and other apparatus which would have to work in a climate capable of causing trouble even in a simple magneto system.

At present the author is entirely in favour of a magneto system, using either mechanically-restored indicators or incandescent lamps controlled by relays.

Experience of enamelled wire has shown that in the tropics it is not altogether satisfactory, especially for small-gauge windings of coils. Two colonies had boards equipped with enamel-insulated wires throughout, but in a very short time various relays failed. On making inspection it was discovered that there were disconnections in their windings. On unwinding the coils, tiny green spots were seen, apparently caused by the damp acting on the copper. This could only be accounted for by assuming that these very fine wires do not, when passing through an enamel bath, pick up the enamel evenly, and either there was at various points a very thin coating of enamel, or else no coating at all. As soon as these coils reached a tropical climate, the damp atmosphere, often laden with salt from the sea, soaked into the coil and acting upon the copper at these weak points ate it through. The only conclusion we can come to is that simple enamel insulation is not suitable for very fine gauge wires, but for all other purposes it certainly seems to give entire satisfaction. We are now in search of something more satisfactory for these coils, which cannot be said to be the case with either silk, cotton, or wool. These faulty coils are at present being replaced by others insulated with silk, the whole coil being then dried in a vacuum, and placed, whilst there, in a bath of "Voltalac," so that this insulating varnish may work its way right into the heart of the coil. It may possibly be sufficient to treat enamel-insulated coils with this "Voltalac," in which case there would still be the advantage of having the coils small. This will be tested shortly. The one drawback to the use of an insulating varnish is that, should any fault occur in it, the complete coil must be scrapped, as unwinding and rewinding on the spot is out of the question. On the other hand, faults in such a coil should be extremely rare, even in the tropics.

Certain types of the mechanically-restored indicators have also given some trouble, especially the "eyeball" type. This is sometimes owing to dust and damp clinging to the eyeball and preventing it rotating. One board of this type which was sent to the tropics had the eyeballs mounted on steel pins; in a very short time these pins rusted badly and "seized." For tropical climates, wherever it is essential to use iron or steel the metal must be galvanised, "coslettized," or coated with some other non-rusting material. The plain metal rusts most rapidly and invariably leads to breakdown. Where phosphor bronze or gunmetal can be used, they are far superior to steel. Even the steel tips on the plugs, though used daily, will have a complete coating of rust in the morning after the night's rest.

The question of operators causes the traffic department considerable worry. In the majority of tropical places it is impossible to employ European operators; for such work the Governments have to rely on half-caste girls or native men, neither of whom, with rare exceptions, have mental equipments comparable with those of European women. With the only available operators, 60 lines to a position is all that can be managed in some places, and 80 lines per position is generally quite as much as can be handled.

One other most trying and frequent worry in an exchange is the objection that subscribers have to "ringing off" after a conversation. To avoid this source of annoyance and the consequent delays in freeing cord circuits, an automatic clearing signal has been fitted to all the boards in the Malay States, even to those for 50 subscribers.

Line.—The normal type of overhead construction now employed in most tropical countries is fairly well standardised. The poles used are either wrought-iron taper tubes with cast-iron bases, or are built up of tubes of riveted sheet steel. In most parts it is hopeless to use wood poles, owing to the prevalence of white ants, which in a very few years demolish the whole of the interior of such poles. The arms, on the other hand, are fairly often of this material, for the white ant will not work its way up 15 or more feet of iron tube to reach these arms, and in some countries most excellent hard wood is obtainable locally.

Where hard wood is not obtainable, tubular iron arms are employed. These arms carry 6, 8, or 12 Cordeaux porcelain insulators, mounted on iron stalks. The very best practice is followed as regards workmanship and finish, yet the average insulation of these lines is very low. The atmosphere, with a humidity of 80 or 90 per cent., naturally has considerable effect in reducing the insulation resistance.

A more troublesome factor, however, is the vegetation; more troublesome in that, whilst the clearing-away of these trees would be of very great assistance in keeping up the insulation resistance, the high cost of doing this in most places, and the reluctance of the Government and the public to allow this work to be carried out, hamper the engineer.

In the towns and suburbs underground cables would obviate the trouble; outside the towns, however, the roads run through dense jungles or thick plantations of rubber trees or coco-nut palms. The normal clearing for roads is 60 ft., but in practice such a clearance is often not maintained; and with even 60 ft. clearings the line must be within 20 ft. of the trees at the best, and is actually often less than 10 ft. Unless a further 50 ft. clearance is made on the side of the line away from the road, and properly maintained, contacts and breakages due to falling trees must remain almost a daily experience. The expense of keeping down the undergrowth is also a considerable annual charge.

Another line trouble that the tropical engineer is bound to experience is caused by insects, some of which delight in making their homes between the petticoats of insulators. The author has seen an insulator so covered with a spider's nest as to be itself invisible, the base of the nest being on the arm and the apex above the insulator. Constant attention on the part of the line men is necessary to prevent the insects getting such a hold on the insulators. It is quite usual to find, formed in a single night, webs glistening with dew and connecting the wire to the insulator stalk, the insulation resistance of the line being reduced as a result to a few ohms. Oil insulators are useless. Mr. Guthrie Spain, the telegraph engineer of British Guiana, first brought to the author's notice the fact that insects will not enter glass insulators. The author is told that glass insulators are used in Cuba for this reason. Apparently these insects prefer a dark place for their home, which obviously is not the case when the insulators are made of glass. The author is inclined to think that if oil insulators of glass could be easily obtained, considerable improvement in the insulation should result.

Another widespread source of line trouble in the tropics is lightning. In many places thunderstorms are of almost daily occurrence throughout the greater part of the year. In certain towns a single storm will often result in 50 per cent. or more of the subscribers' telephone lines being earthed at the pole boxes, this being caused by the strong discharges through the protectors to earth, which carry so much carbon dust across the gap as to place the two carbon blocks in contact; so that practically after every storm a number of line men had to be sent to all those boxes to clean the protectors.

This trouble can, however, be cured to a great extent by using the vacuum type of protector, in which the two carbon blocks are inserted in an exhausted glass tube, the opposite surfaces being serrated and fixed about 1/16 inch apart. These protectors are now used to a considerable extent by Mr. Cadman in the Malay States, and are, the author believes, found to be quite satisfactory. Occasionally an extra heavy discharge will burst the tube, but they are very easily replaced. This possibility, however, makes it essential that fuses shall also be inserted, for if a discharge were so heavy as to burst the protector, the line would be no longer protected and a subsequent discharge might damage the cable seriously.

The one disadvantage of these protectors was their size, which involved the use of a very large pole box, even for 25 lines; but a new type of box designed early this year has practically solved this difficulty. An earthed iron wire stapled to the tops of the poles, and also connected to their earth-wires, has been found most effective in guarding the lines from lightning.

For underground work in the tropics the usual practice is to use armoured lead-covered air-space cables terminating in boxes on distribution poles, and hitherto the engineers have followed the British Post Office practice of making the joints so that dry air can be periodically pumped through. The author is inclined to think that the American solid joint would give much less trouble. If the cable were well sealed with paraffin wax immediately it was opened for jointing, the damp could not enter it unless the lead covering was damaged. If such an accident did happen, the length would have to be replaced. Exactly the same result must, however, occur if the practice is to employ open joints and dry air pumping. Once the damp has the chance of entering a cable in the tropics, no amount of pumping will drive it out completely, and the length must be replaced without much delay.

Armoured lead-coloured cables are normally very free from faults, except those due to damage caused by men working on the roads. There is in Shanghai a curious flying insect which is able to bore holes in which to lay its eggs in the lead covering of overhead cables, but the author knows of no case in a tropical country where an insect has damaged an armoured lead-covered cable, or where the damp has caused faults if the joints are securely protected. In low-lying water-logged soil it has been found desirable to lay the cables in troughs filled with bitumen, but otherwise armoured lead-covered cable gives extremely little trouble.

Staff.—The last trouble peculiar to the tropics to which the author wishes to refer concerns the local staff. It would obviously be far too expensive to obtain from England not

only engineers, but inspectors, foremen, and line men. Speaking generally, no white man can live in the tropics—with any pretension to comfort—on less than £250 per annum; and in countries where the men have to pay for their voyages home and back when leave is granted, they should receive about £300 per annum if there is to be any chance of keeping them contented. As such salaries are prohibitive, native labour is essential for the lower grades on the technical staff. Unfortunately, whilst these natives can be trained by the engineers, they must, unless a complete white superintending staff is provided, be left very largely to look after themselves in carrying out their duties. Most natives have not the smallest conception of responsibility, nor have those who are made inspectors any power of command. Thus the engineering department is largely dependent for the maintenance of lines on native linemen, who are very much inclined to neglect their work, and on native inspectors who have no power of controlling these linemen, and who are equally ready to slack; whilst in the majority of the tropical colonies the chief engineer is kept too short of technical assistants to allow of proper supervision of this native staff.

This is largely due to the somewhat unfortunate but universal practice of making the telegraph and telephone department a branch of the Post Office. For as the engineer is a subordinate officer in the postal department, he naturally ranks with postal subordinate officers, although the whole responsibility of the maintenance and extension of the telephone and telegraph systems of the colony rests on his shoulders. In consequence of this practice, the engineer's salary is in every case lower than it should be. Further, as his superior officer and the heads of the Government are very rarely technical men, they are unable, in many cases, to appreciate the desirability of the engineer's proposals, nor do they realise the importance of allowing the chief engineer a sufficient number of trained assistants, or, often, of granting reasonable salaries.

As it is now, the technical appointments in all tropical colonies are too few, and as even these are not made sufficiently attractive, it is difficult to fill them.

The tropical engineer, taking things all round, richly deserves our sympathy and also the esteem of the profession for the way in which he steadily tackles this trying work, though almost invariably under-rated, under-paid, and overworked.

OUR LEGAL QUERY COLUMN.

"Law-less" writes:—"Can you inform me if a municipal authority which possesses no special powers with regard to wiring, hiring, show-rooms, etc., is legally justified in opening show-rooms for the display of fittings, apparatus, etc., provided that no articles are disposed of, inquirers being referred to contractors or manufacturers?

"In the recent case of the Ilford Gas Co. *v.* Ilford Council, judgment was given against the defendants on various points, one being that of their show-room, which was ordered to be closed.

"In a note in one of your contemporaries of the 18th inst., it is stated that when the Doncaster and Dewsbury Bills were recently before the House of Lords Committee, a representative of the Board of Trade stated there was no need to include the clause relating to show-rooms, as all authorities already had these powers under the General Act. Is this so and, if so, where may these powers be found as I cannot trace them?"

*** It is difficult to understand why the contention referred to in the last paragraph of this query was allowed to prevail before a Committee of the House of Lords, because there is no *public* Act of Parliament known to this writer which confers any such rights on local authorities supplying electricity. In his notes to S.25 of the Electric Lighting Act, 1882, the learned editor of "Will's Law of Electric Lighting" writes:—"In the absence of statutory authority, undertakers who are a local authority cannot provide lamps, fittings, motors, or apparatus other than meters which are provided for by Ss. 52, 55, and 56 of the Schedule to the Electric Lighting (Clauses) Act, 1899. . . . It is now quite common to find in the special Acts of local authorities a clause enabling them to sell, let, hire, etc., but not to manufacture lamps, meters, electric fittings, apparatus, etc." He cites, as illustrations, the Acts obtained by the following towns: Nottingham, Manchester, Halifax, and Leith. In London, of course, the borough councils are authorised to supply fittings by the London County Council (General Powers) Act, 1906 (6 Edw., 7c. cl.).

As to the first question, if a local authority may not expend the ratepayers' money in the business of selling fittings, it seems reasonable to suppose that no expense must be incurred on things ancillary to such a business.

Prices Advance. — The British Thomson-Houston Co., Ltd., announce that from April 7th there will be a 10 per cent. advance on the price of their electrical fittings.

BUSINESS NOTES.

Catalogues and Lists.—Messrs. J. H. Tucker & Co., King's Road, Hay Mills, Birmingham.—Illustrated and priced folder relating to their new pattern ironclad switches.

Messrs. Bergtheil & Young, Ltd., Finsbury Court, London, E.C.—Booklet containing illustrations and brief particulars of "Bandy" patent single-phase motors. The pictures all represent photographs of actual installations, the motors being used for crane driving, pumps, lifts, transporters, printing presses, &c.

The Coventry Chain Co., Ltd., Spon End Works, Coventry.—Pamphlet emphasising the silence of the "Coventry" chain drives. Also a 72-page catalogue (Engineering Section), very fully illustrated, describing the "Noiseless" chain and its principle and the methods of guiding it on the wheels. Many pages are occupied with tabulated data relating to wheel sizes, chain lengths, teeth, hints to users, and so forth.

Messrs. P. E. Chappuis & Co., 85, Fleet Street, London, E.C.—8-page illustrated and descriptive price list of Chappuis's trough reflectors for "Striplite," tubular and ordinary tungsten lamps; also "Conoid" silvered reflectors.

Messrs. W. N. Brunton & Son, Wire Mills, Musselburgh.—40-page pocket catalogue giving tabulated particulars and prices of their silver steel, drill rod steel, high speed steel rods, and steel wires for hardening and tempering. Copies will be sent to any interested reader on application.

Messrs. Higgs Bros., Sherbourne Road, Balsall Heath, Birmingham.—20-page catalogue containing illustrations of their motor-generators and booster sets, brushgear, "C" type shunt and series motors, from $\frac{1}{16}$ to 25 H.P., "C" type shunt generators, controlling gear, starting switches, &c. A special copyrighted system of listing dynamos is adopted. Prices and dimensional and shipping particulars are tabulated.

Temple Press, Ltd., 7-15, Rosebery Avenue, W.C.—New catalogue of technical manuals, touring handbooks, &c.

British Thomson-Houston Co, Ltd., Rugby.—Illustrated price list No. 7,100B, giving particulars of B.T.H. fan motors and exhaust fans.

Staff Supper.—About 30 members of the headquarters (Manchester) supply department staff of the British Westinghouse Electric and Manufacturing Co., Ltd., sat down to an excellent hot-pot supper at the Exchange Hotel, on Monday evening, March 29th. Afterwards there was a smoking concert, at which Mr. J. Gibson (manager of the supply department) presided, 50 members of the supply staff and a few specially invited guests being present. During the evening the chairman said that so far as the turnover of the department was concerned they had been successful to the extent of an increase of about 30 per cent. He felt sure they missed several old faces, particularly that of his chief assistant, Mr. G. Ellam. As they all knew Mr. Ellam had been away many months in Russia, and he was doing good work for the department. Before sitting down he asked them to drink silently to the memory of those who owing to the war would never return. During the evening the following toasts were enthusiastically honoured:—"The King," proposed by Mr. J. Gibson; "His Majesty's Forces," by Mr. L. E. Wilson; "The Westinghouse Co.," by Mr. W. S. Robson, this toast being responded to by Mr. W. J. Hollick; "Our Visitors," by Mr. A. Pougher, responded to by Mr. L. E. Wilson; "Our Chairman," by Mr. H. H. Bent, responded to by Mr. J. Gibson. The following artistes contributed to the entertainment of the company:—Messrs. A. Pougher and T. Jackson as pianists, Mr. A. Pougher (flautist), Mr. T. E. Kenyon (humorist), Mr. T. Clough (elocutionist), Mr. O. C. Oakley (baritone), Mr. W. S. Robson (violinist), Mr. McColl (humorist), Mr. F. Freeman (elocutionist), Mr. D. E. Elliott (Newcastle dialect recitation), and the "Inharmonius Four," who caused great merriment by their vocal efforts. The proceedings terminated with the singing of "Auld Lang Syne" and "God Save the King."

Charge of Stealing. — Sentence. — Before Judge Rentoul, at the Central Criminal Court, on Tuesday, Raoul de Redon, 32, electrician, pleaded guilty to counts of an indictment charging him with stealing one electric battery, and one X-ray tube, the goods of the Governors of the London Homœopathic Hospital, one X-ray tube and one milliamperemeter, from the West London Hospital, one X-ray tube from the Royal Free Hospital, and similar articles from Hampstead General Hospital, and Guy's Hospital. Counsel for the prosecution said that, for some time past various articles had been missed from the surgical departments of London Hospitals, and, information being given to the police, inquiries were made, which resulted in the arrest of the accused, who, it was alleged, had been found dealing with the stolen articles, soon after the thefts, for sums of money considerably below their cost price. It was stated that the hospital authorities had been put to the greatest trouble and inconvenience in consequence of the theft of X-ray apparatus and other surgical appliances. Judge Rentoul sentenced the prisoner to three months imprisonment in the second division.

Liquidations. — Otis Elevator Co., Ltd. — This company is winding up voluntarily, with Mr. R. P. Sellon as liquidator. A meeting of creditors is called for April 14th.

Spanish National Submarine Telegraph Co., Ltd.—This company is winding up voluntarily, with Mr. J. Jeffery, of 106, Cannon Street, E.C., as liquidator. A meeting of creditors is called for April 12th.

Bankruptcy Proceedings.—George I. T. Parfitt, 11, Priory Road, Keynsham, near Bristol, Somerset, consulting electrical engineer.—The receiving order in this matter was made on the petition of a creditor, the act of bankruptcy being the failure of the debtor to comply with the requirements of a bankruptcy notice served upon him. According to the statement of affairs the liabilities amount to £2,024, to meet which there are no assets. It appears that until 1888 debtor was employed as an electrical engineer, but at that date he and his brother-in-law took over the book debts and liabilities of an electrical engineering business carried on at 9, Denmark Street, Bristol. They paid £320 for the goodwill and stock-in-trade, and continued the business under the style of Parfitt, Webber & Co. Debtor introduced a capital of about £300 on commencing, and has since put in further capital, amounting to about £1,700, while his partner has from time to time introduced capital of about £600. In 1912 the partnership was dissolved, the partner going to South Africa, but no formal dissolution took place, and the business was continued by the debtor. The partner returned from South Africa about the end of 1913, and on January 20th, 1914, they transferred the business to the Colston Electrical Works, Ltd., in consideration of £1,650, payable in £1 ordinary shares, of which 450 were allotted to Mr. Webber (the partner), 450 to the debtor, and 450 to his sister, in consideration of moneys advanced to the firm, 200 to the manager of the business for wages and money advanced, and 100 to Mr. E. Brock for services rendered to the firm prior to and on the formation of the company. The company took over the whole of the assets and liabilities, with the exception of £420 owing to seven trade creditors and the overdraft at the bank, which amounted to about £750. Certain payments have since been made to these trade creditors on account of their claims. Debtor has undertaken several contracts for the supply of electrical plant and fittings. A full set of books was kept prior to the sale of the business to the company, but no books of account have been kept since that time. The failure is due to losses for goods supplied to, and through guarantees given for, a certain firm, which went into liquidation, and loss of business occasioned by the war, and debtor admits knowledge of his financial position last October. The following are the creditors :—

Crompton & Co.	£20
Edison-Swan Co., Ltd.	112
General Electric Co.	25
Higgins & Sons, Ltd.	22
Fletcher & Co.	84
Siemens Bros. & Co.	64
Willey & Co.	71

H. J. Godfrey, electrical engineer, 188, Balham High Road.—Last day for proofs for dividend April 16th. Trustee, Hon. W. J. H. Boyle, Official Receiver, 132, York Road, S.E.

Private Arrangements.—The British Prometheus Co., Ltd., Salop Street, Highgate, Birmingham, Warwick.—The following are among the creditors :—

Attwater & Sons	£21	Jaroslaw, D.	£56
Bridgwater, W., & Sons	35	Meakin & Parkes, Ltd.	38
Clane Manufacturing Co.	19	Pugh, E., & Co.	179
Doulton & Co., Ltd.	125	Prometheus G.M.B.H.	72
Diamond Foundry Co.	43	Restall, Round & Gloster	34
Electrical Press, Ltd.	46	Rigby, Robt.	78
Electrical Review	62	Von Schwartz, J.	20
Electrical Times, Ltd.	38	Siemens Bros. Dynamo Works Co.	24
Edison & Swan, Ltd.	50	Voight & Haeffner England, Ltd.	26
Electrical Printing Co., Ltd.	16	Wacker & Doerr	40
Forman, T., & Sons	15	Haselwood & Dent	20
Hoskins & Sewell, Ltd.	17	India-Rubber & Gutta-Percha Co.	20

Book Notices.—"*Journal* of the Institution of Electrical Engineers." Vol. LIII, No. 245. April 1st, 1915.—This issue contains papers on "Electric Cooking, mainly from the Consumers' Point of View," by W. R. Cooper; "Registering Trains of Electricity Supply Meters," by S. Evershed; "Dimensions of Transformers," by A. R. Low; "Relation Between Flux and Magnetising-Current Waves at High Flux Densities," by A. L. Tackley; "Distribution and Rise of Temperature in Field Coils," by Prof. M. Maclean, D. J. MacKellar and R. S. Begg; and "Electric Furnaces," by T. D. Robertson. London: E. & F. Spon. Price 3s. 6d.

"Submarines, Torpedoes and Mines." By W. E. Dommett. London: Whittaker & Co. Price 1s. net.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIV, No. 3. March, 1915. New York: The Institute. Price $1.

"Scientific Papers of the Bureau of Standards." No. 239, "A Vibration Electrometer." No. 234, "Insulating Properties of Solid Dielectrics." Washington: Government Printing Office.

Trade Announcements.—Messrs. Parmiter, Hope and Sugden, of Manchester, have opened a London office at Queen Anne's Chambers, Westminster, under the direction of Messrs. Nathan & Allen. Samples of the new Fluvent fuse system may be seen there.

Messrs. Newton Bros, electrical and mechanical engineers, of Derby, have converted their business into a limited company (Newton Bros. (Derby), Ltd.). All debts and liabilities of the firm are undertaken by, and all debts due to the firm are to be paid to, the company. The directors are Mr. C. A. Newton, Mr. R. Newton and Mr. H. Newton, and the constitution and control of the business will be precisely as heretofore, the alteration not in any way interfering with the management or scope of the undertaking.

Larger premises at 329, Lord Street, Southport, have been opened by Messrs. T. Wainwright & Sons, Ltd., electricians.

Italy.—An agent in Milan desires to represent United Kingdom manufacturers of parts of electrical and mechanical plant. Inquiries should be addressed to the British Consulate, Milan.

LIGHTING and POWER NOTES.

Australia.—According to the *Sydney Evening News*, an agreement was practically reached between the North Sydney Council and Sydney City Council, for the latter to carry out the electric lighting in North Sydney.

The proposal for the Sydney Council to purchase a coal mine has now been abandoned.

Singleton (N.S.W.) is considering the question of an E.L. installation, and two estimates have been obtained.

Barking.—New Plant.—The Electricity and Tramways Committee has adopted the recommendation of the acting electrical engineer for the installation of a 1,000-kw. Ljungstrom turbine set at the electricity works.

Barrow.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £12,500 for the electricity undertaking. The Council approved of £124 being distributed amongst the staff of the electricity works as remuneration for the extra work thrown upon it in connection with the extensions carried out during the past 18 months.

Blackburn.—The T.C. has decided to apply to the B. of T. for consent to the construction of a generating station on land at Whitebirk recently leased by the Corporation.

Boston.—E.L. Scheme.—The R.D.C. has, on the invitation of the B. of T., decided to send representatives to confer with other interested parties on the proposed E.L. scheme for the district.

Cahir (Co. Tipperary).—Proposed E.L.—A public meeting has considered proposed increases in the prices of gas, and decided to form a company for the introduction of electric lighting. A committee was appointed to deal with the matter.

Chelmsford.—Restricted Lighting.—The Electric Supply Corporation, Ltd., has offered a rebate of £112 in respect of the public lighting account for the quarter ending December 31st, on account of the restricted lighting.

Colne.—A Sub-Committee of the T.C. is considering the question of adopting an optional system of charging for electricity on the rateable value basis, with a secondary charge of, say, ¾d. per unit for current consumed through one meter for all purposes.

Croydon.—The charge for electrical energy for lighting on the flat rate has been increased by ½d. to 4d. per unit as from March 25th. It was stated that the increased cost of coal was equivalent to an increase of £9,000 per annum; the extra charge would bring in £3,000 to £3,500. The Committee is going into the question of increasing the charge to the tramways, which it is believed, with one exception only, is the lowest in the kingdom.

Darlington.—Proposed Loan.—A loan of £3,400, to cover the cost of additional plant required for the proposed supply to the North-Eastern Railway Co., has been applied for by the T.C.

Dublin.—Electricity Report.—In compliance with the resolution of the T.C., the city treasurer and city accountant have issued a report on the financial side of the Corporation electricity undertaking for the seven years ended March 31st, 1914. This contains a great many figures, from which we abstract the following :—Total capital borrowed, £790,717; indebtedness, £592,844. Deficits since 1907-8 total £16,270 and surpluses £30,814. The amount paid by levy from the rates was £4,147, and paid by the undertaking in relief of rates, £5,500. The consumers increased from 1,687 in 1908 to 6,372 in 1914, and the units sold from 2,720,226 to 7,091,729 in 1914.

During the seven years to March, 1914, £299,811 was expended on capital account. The total amount levied upon the rates since the inception of the undertaking in 1891 was £52,174, the net amount standing at £46,674 for 23½ years. In the last 10 years no charge has been made on the rates, and some £1,363 has been paid in relief of them. In the five years to 1913-14 the revenue from consumers rose from £38,354 to £87,810; for the year 1914-15 to March 18th receipts from private consumers (excluding Corporation departments) amounted to £85,733, an increase of £10,813 on the corresponding figure of the previous year.

While power and heating supplies increased to over 43 per cent. of the private supply in 1913-14, the load factor only increased from 13·47 to 13·99 during seven years, and the reporters suggest consideration of the regulation of the proportion of the power and heating supply, and the possibility of some differentiation in power rates to ensure that current shall be sold at an economical figure. They also agree with the proposed temporary increase in price put forward by the Electricity Committee.

Gillingham (Kent).—Owing to the increased cost of fuel, &c., the T.C. has, from April 1st, increased all rates for current for lighting by ½d. per unit.

Messrs. E. J. & W. Goldsmith have asked for an estimate for the cost of connecting the Rainham Cement Works with the mains.

Elland.—The Council has advanced the price of current for lighting purposes, and the prices for power supply will probably have to be increased.

Hereford.—Proposed Loans.—The T.C. has been informed that the application for a loan of £1,000 for services, cannot at the present time be sanctioned, and in consequence no connections will be made until the end of the war to premises where mains do not already exist. A further loan of £8,000 for plant extensions was about to be asked for, but has been abandoned.

Heywood.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £6,440 for electricity purposes.

Holmfirth.—E.L. Scheme.—The U.D.C. has defined the compulsory area on which work should be commenced under the electric lighting order, and has also decided that the building of the generating station should be let by tender in one contract.

Irish Water Power Schemes.—A private company has been formed to carry out extensive electric supply schemes at Belleek in the north, where the waters of Lough Erne would be used, and at Limerick, in the south, where it is proposed to utilise the River Shannon.

Japan.—The Japanese Department of Communications has just issued a revised series of regulations in connection with electrical undertakings in Japan, particularly those connected with the generation and distribution of electrical energy for power purposes. Among the new regulations are conditions with regard to standard periodicities and distribution pressure, provision for the transmission of current from one system to another in case of breakdown, simpler formalities for the conveyance of power plants in accordance with the Factory Mortgage Law, and the stricter enforcement of the official inspection of private companies, power distribution, and supply terms and procedure.

Keighley.—The T.C. has decided, in response to the L.G.B. circular endorsing the requirements of the Committee of Imperial Defence for more army recruits, to permit those of its servants who are not absolutely indispensable to enlist or enter urgent Government services, and that no men of military age, unless they have been rejected in respect of army service within a month previous to the application, should be accepted for employment in the Council's works departments.

The Electricity, Gas and Water Committees have been instructed to confer as to the best means of avoiding a danger arising out of the possibility of the fusing of gas mains which are laid near electricity cables; it was reported that recently an 18-in. trunk gas main had been fused near a large works in the town.

Kingstown.—Electric Supply Arbitration.—Last week Mr. Justice Barton, in the Chancery Division of the Irish High Court, granted an application by the Dublin Southern District Electric Supply Co., Ltd., making an arbitrator's award as to the payment of £3,608, as the price to be given by the Kingstown Urban Council for the electric lighting undertaking a rule of Court. The solicitors for the Dublin Southern District Electric Supply Co., writing to the Dublin Press, point out that the Arbitrator by his award decided that the Kingstown Council should pay £3,608 for the undertaking; the Arbitrator's fees, amounting to £183; and the costs of, and incidental to, the arbitration proceedings and the award. Further, it was pointed out that the Kingstown Council, notwithstanding the fact that a letter had been written to its solicitors that the deed of transfer would be returned approved of immediately the order was obtained, filed an affidavit to prevent the obtaining of an order, thereby compelling the company to bring the motion which had been decided by Mr. Justice Barton. The costs against the Council, and their own costs, will amount to £30.

Leyton.—New Plant.—Application is to be made to the L.G.B. for sanction to borrow £1,000 in respect of new services. The Electric Lighting Sub-Committee has had under consideration a report of the electrical engineer in regard to the necessity of providing additional plant at the generating station, at a cost of £17,158, and in connection therewith an offer of the Hackney B.C. to give a bulk supply.. The Council has decided on the provision of additional plant as recommended by the engineer.

London.—Woolwich.—The B.C. has received a letter from the L.C.C. with regard to the application for the balance of the loans required in connection with Globe Lane works extension. In this letter the County Council's Finance Sub-Committee states that it is now in a position to deal with the Borough Council's application for £35,000, but that the balance (£13,000) will have to stand over until a more detailed statement is supplied by the Borough Council, showing how the total estimated cost of these extensions, which amounts to no less than £77,000, is arrived at. From a statement of the loans to be dealt with, it appears that the total amount of loans granted for 42 and 39 years for plant and machinery is £64,732, and the condition proposed to be attached to the Council's loan sanction is that the amount outstanding at April 1st, 1920, in respect of this sum be repaid within one-half of the periods then unexpired of the loans in which the amount in question is included. Subject to this condition, the Sub-Committee has agreed to recommend sanction to the borrowing of £35,000, as follows:—Buildings, £9,000, 30 years; plant and machinery, £26,000, 15 years. The Finance Committee of the B.C. recommends the Council to accept the conditions attached to the County Council's sanction to the £35,000, it being understood that no further conditions will be imposed when the further balance of £13,000 yet required is dealt with. At a meeting of the B.C. this recommendation was agreed to. H.M. Office of Works has given the B.C. permission to wire some 200 houses, forming a portion of the Government housing scheme at Eltham, and to provide the necessary fittings, including lamps. Application is to be made to the L.C.C. for sanction to borrow £2,172, the cost of carrying out the work. In addition, it will cost £443 to provide the necessary transformer, kiosk and services.

Kensington.—The General Purposes Committee of the B.C. has considered a letter from the Notting Hill Electric Lighting Co. relative to a proposal to increase the price of current from 5d. to 5½d. per unit, and suggests that this should be assented to by the Council.

Maidstone.—Increased Charges.—The T.C. has decided owing to the extra cost of coal, to increase the price of current for lighting and heating by ½d. per unit from April 1st, and by ¼d. for power as from January 1st.

Manchester.—A letter has been received from the L.G.B. stating that the sanction issued on August 15th, 1908, authorising the borrowing of £1,000 for the purposes of the electricity undertaking, has been cancelled.

Richmond-on-Thames.—The Electric Supply Co. has informed the B. of G. that the price of current has been increased by 10 per cent.

Salford.—Great dissatisfaction is felt by the inhabitants in connection with the lighting of the streets of the borough, and the attention of the Military Authorities has been called to the state of affairs.

The Electricity Committee has given instructions that no further extensions of mains and services be carried out during the war except in those cases where, in the opinion of the electrical engineer, they are absolutely necessary.

Sheffield.—L.G.B. Inquiry.—An inquiry was held on the 31st ult. relative to the Corporation's application for sanction to borrow £164,373 for extensions to the electricity works and plant, to enable it to supply much needed assistance to the large armament works which are now engaged at top pressure on Government orders.

South Africa.—A ratepayers' meeting has been called for April 23rd to adopt a resolution to borrow £15,000 for providing for the cost of the hydro-electric scheme at Worcester, Cape Province.

The East London (Cape Province) T.C. proposes to spend £20,034 on the electricity supply undertaking for extensions and additions at the power station and to the distribution system.

The Wellington (Cape Province) Municipality proposes to borrow the sum of £1,500 for extensions to the electric light works and the purchase of fittings and accessories.

Southampton.—Year's Estimates.—The estimates of the Electricity Committee show that it is expected to receive £53,860 from the sale of energy, meter rents, and miscellaneous receipts during the ensuing year. This represents an increase of £758, as compared with the actual amount received during 1914-15, and a decrease of £3,614 as compared with the estimate for that year. Expenditure during the next 12 months is estimated at £36,408, leaving a gross profit of £17,452, as against £19,940 for 1914-15, and for which the estimate was £21,201. From this amount has to be deducted £16,254 in respect of interest and redemption charges, and £1,100 for special expenditure, leaving £98 available for appropriation. This figure compares with £230 during 1914-15, and £1,948 the estimate for that period. The Electricity Committee is considering the question of extinguishing street lamps at midnight between March and September.

Stockton-on-Tees.—L.G.B. Inquiry.—An inquiry was held on March 30th into the application by the T.C. for sanction to a loan of £10,100 for mains, services, and rotary converters, &c. There was no opposition, and it was explained that current was being largely supplied to shipyards and works engaged on Government work, and that the extension of plant was urgent.

Swansea.—An official inspection has been held of the new three-phase plant at the electricity works, estimated to have cost in all some £40,000. The Mayor started up a new Curtis turbine set.

Torpoint.—E.L. Scheme Inaugurated.—The public lighting scheme of the Torpoint Electrical Supply Co. having been completed, the new generating station was opened by Lady Beatrice Pole-Carew on the 31st ult. The constructional work was carried out by Messrs. Brooking & Co., of Exeter, and about 90 public lamps are to be lighted.

Upper Greetland.—The Yorkshire E.P. Co. has applied to the B. of T. for consent to the erection of overhead lines in the district for the supply of current at a pressure of 400 volts.

Venezuela.—La Compania Electro-Industrial de Barquisemeto is the name of a new undertaking that has lately been organised, with a capital of £20,000, to establish an electric lighting station and ice-making plant in the town of Barquisemeto.

Worthing.—Public Lighting, &c.—The Electricity Committee of the T.C. has been considering the question of revising the charges for electricity supplied for public lighting. The Highways Committee has agreed to a new arrangement for paying the actual capital and maintenance charges on so much of the plant as is provided for public lighting purposes plus the actual running cost of producing the current supplied. Had this system of charging been in operating during the whole of the past financial year it would have meant a saving of £242, as compared with the system of charging a flat rate. The expenditure on the electric light account during the past year totalled £11,497, the income amounted to £11,453; an estimated surplus of £617 became an actual deficiency of £44. In the financial year ending March, 1914, the undertaking contributed £500 of its surplus to the district fund for the reduction of the rate.

Worcester.—L.G.B. Inquiry.—Mr. H. R. Hooper resumed the inquiry last week into the application of the City Council for sanction to borrow £5,250, £1,973 and £800 for purposes of the electricity undertaking. The inquiry was adjourned for the preparation of particulars of the expenditure on loans previously granted. The inspector stated that the Treasury would not sanction loans for any extension of the undertaking unless it was necessary for war purposes, and pointed out there was an excess expenditure on loans of £1,959, which was as far as they could deal with the application; the other part must stand over.

TRAMWAY and RAILWAY NOTES.

Australia.—Twenty-six municipalities in the Melbourne area have held a conference to discuss the question of damage to roads by motor traffic, and the provision of means to regulate such traffic. A committee strongly recommended some form of special taxation of motor-'buses, which are the worst offenders, to be based, it was suggested, on mileage run.

Bolton.—War Bonuses.—A scale of war bonuses has been prepared to apply to adult or married workmen in the various Corporation departments whose wages in any week do not exceed 30s. The bonuses range from 3s. down to 6d., and their payment will involve an annual expenditure of £3,700.

The Tramways Committee has under consideration a letter from the Electrical Trades Union making application on behalf of those members who are employed in the tramway department for an increase of 5s. a week in wages.

Brazil.—According to the *Financier*, the Pernambuco Tramways and Power Co. has at length succeeded in running cars in the more central parts of the town. Some considerable time must elapse before the electric tramway system reaches the suburbs where it is much needed, as the existing system, which has been bought by the company, is quite inadequate. An arrangement for lighting the city, made with the same concern, has now been in operation for nearly a year, with satisfactory results.

Bristol.—Tramways Purchase.—We understand that in addition to the gentlemen named in our issue of March 26th, Mr. H. Faraday Proctor, the city electrical engineer, was also nominated by Sir John Snell to take part in the joint valuation of the sections of the Bristol tramways which are purchasable by the Corporation.

Dunfermline. — Tramway Inquiry. — Under the Private Legislation Procedure Act an inquiry has been held in Edinburgh in connection with the Dunfermline and District Tramways (Extension) order. Power was sought to construct a tramway from Dunfermline to Rosyth by what was known as the Queensferry Road route. The Burgh of Dunfermline and the Earl of Elgin objected to the scheme on the ground that a tramway linking up the same districts by the Grange Road route had already been authorised. It was stated that in the event of the Grange Road route not being constructed the Dunfermline town planning scheme could not be carried out.

After Counsels' addresses, Lord Wemyss announced that subject to the adjustment of clauses and to a promised addition to Clause 4, the Commissioners unanimously found the preamble proved. The effect of the addition to the clause is that the company will construct, within 18 months from the commencement of the order, but subject to limitations imposed by war conditions, the tramway from the dockyard gates to the new station and along the Queensferry Road up to the High Street of Dunfermline.

Edinburgh.—According to the burgh engineer, there are in the city 64 double-decked cars out of 200. With regard to the question of increasing the number, it was reported that a difficulty existed in respect to the low roofing of the existing tramway sheds, and that a considerable expense would be involved in raising the roofs to admit of any considerable additions to the number of double-decked cars. There was also a difficulty as regards haulage, the present power being unequal to the strain of carrying on the various routes of the city a very large proportion of double-decked cars. From inquiry it appeared that 20 to 25 of these cars could be added to the existing number with very little difficulty, and the Tramway Committee of the T.C. is to suggest to the company that another 25 such cars be put on the various routes.

The Tramway Committee is endeavouring to get a self-propelled car for experimental purposes, and is to gather information as to the part self-propelled traction might play in the city.

Halifax.—Year's Working.—The income of the Corporation tramways for the year ended March 31st was £112,792, as compared with £109,650 in the preceding year. This is the largest figure since the system was opened. The profits amount to £17,539, or nearly £3,000 more than last year. The number of passengers carried was 20,707,071.

The Tramways Committee has decided to allow Belgian refugees to travel free of charge on the tramways, and special passes are being issued to these people.

Manchester.—The Special Corporation Committee appointed to deal with the question of the congested traffic in Manchester has held its first meeting and elected Ald. J. R. Wilson (chairman of the Improvements Committee) as chairman, and Ald. T. C. Abbott, deputy-chairman. It is understood that of the three voluminous reports prepared on the subject of traffic congestion by the Improvements, the Watch and the Tramways Committees, the report of the Tramways Committee will be first considered. The first business meeting of the new Committee will be held on April 13th.

A resolution is to come before the City Council that the Tramways Committee be recommended to allow special constables free rides on the tramcars when going to or returning from duty.

It is understood that some of the members of the Tramways Workers' Union are seeking permission to take a ballot on the question of the withdrawal of labour in consequence of the City Council's refusal to grant the increases in wages of 4s. 6d. and 3s. 6d. for carters and carriers and labourers.

Newcastle-upon-Tyne.—Reserve Fund.—At a meeting of the City Council on March 31st, it was stated that the reserve and renewals fund at March 31st, 1914, stood at £94,337, the estimated surplus on the year's working to March 31st, 1915, was £25,350, making a total of £119,687, from which is to be deducted expenditure sanctioned by the Council, leaving in the reserve and renewals fund on March 31st, 1915, the sum of £75,013. The estimated surplus for the year ending March 31st, 1916, was £31,400, but since the last report was issued the following additional estimated expenditure had had to be considered:—Army allowance for dependants (additional), £1,516; war bonus, £8,320; relief of rates, £18,000; additional cost of fuel, £5,000; reduced interest on investments, £1,000. There was, therefore, an estimated deficit of £2,436 on the year's working. Further, it would be necessary to expend from the reserve fund a minimum of £18,000 to keep the undertaking in a working condition, and with these deductions the reserve fund at the close of the year would only stand at £54,577. It would be impossible permanently to reduce the necessary expenditure on renewals in future years below an average of about £25,000 to £30,000 a year until the completion of the repayment of the loans. The Committee was of the opinion that the reduction of the reserve fund to so low a sum as £54,000 was unsafe, and that the contributions to the rates should be reduced in future years until the reserve fund was again built up to not less than £100,000. Alderman Rodgers, chairman of the Committee, in moving the adoption of the report, said the Committee must be allowed to accumulate an adequate reserve fund. He suggested that the allowances to dependants and the war bonus to employés should be deducted from the £18,000 which it had been proposed to allow towards the rates. After discussion the report was adopted.

Portsmouth.—The Tramways Committee has decided against an application of the motormen and conductors for an immediate permanent rise of 5s. per week in wages.

Salford.—It is estimated that the profits of the department will be less by nearly £20,000 this year as compared with last.

Destination numbers on the cars have not proved satisfactory, and the Tramways Committee has decided to recommend that the previous method of indicating on the cars both the route and the destination be reverted to.

Venezuela.—A company has lately been formed to construct and work an electric tramway in the town of Valencia. The work of constructing the line is well in hand, while the necessary current will be supplied from the plant of the existing electric light undertaking.

Wigan.—The Home Office communicated with the Corporation last week with reference to a proposal not to run the cars on Good Friday, and pointed out that the colliers had decided, at Lord Kitchener's request, to restrict their usual holiday and to work on the Friday, and that they would be seriously inconvenienced if the cars did not run. At a special meeting of the T.C. it was stated that the arrangements were made without knowing what the collieries intended to do, and it was decided to provide a service of cars.

TELEGRAPH and TELEPHONE NOTES.

Greece.—Direct communication has been established between Greece and Bulgaria and between Greece and Servia.—*Journal Télégraphique.*

High-Speed Cable-Cutting.—Speaking at Bristol on March 29th, the Postmaster-General said that within four hours of the outbreak of war we had severed every German cable that ran from Germany westwards or eastwards under the sea.

Japan.—Direct telegraphic traffic has been inaugurated between Russia and Japan, by way of the Korean port of Chonjin and Vladivostock.—*Journal Télégraphique.*

Postal Telegraphs and Telephones. — An account recently issued by the Post Office shows that the gross revenue of the British telegraph and telephone services for the year ended March 31st, 1914, was £10,468,399; the amount paid to cable companies, foreign countries, &c., was £878,316; telegram moneys refunded were £3,383; and the amount received in respect of royalties from the National Telephone Co., Ltd., and other licensees was £47,786; while services rendered to other public departments without remuneration were valued at £119,458. The total expenditure, including £1,000,000 for interest and part repayment of capital in respect of the purchase of the National Telephone Co.'s plant, was £9,821,978, leaving a debit balance of £68,034.

The amounts raised for telephone purposes to date made a total of £17,390,000, leaving a balance of £9,910,000 authorised but not raised. The excess of expenditure and interest on telegraph stock over telegraph and telephone revenue for the year was £339,725. The capital expended on the trunk telephone system amounted to £7,549,963; on the exchange system and private wires, including £10,709,249 paid to the National Telephone Co., to £20,096,117; and on stores not allocated to £800,000, making a total of £28,146,080.

The expenditure for the year on the telegraphs was £3,509,010, exceeding the income by £390,794; including the interest on the purchase price of the telegraphs, the estimated pension liability, and provision for depreciation, the deficiency of revenue for the year was £1,211,742.

The expenditure on the telephone service was £3,385 796, and the revenue £6,175,372, leaving a balance of £2,789,576; after deducting interest on loans, pension liability, provision for depreciation, &c., the net surplus was £239,111. The working of the exchange system showed a net profit of £395,664, and of the trunk system a net loss of £156,553. The deficiency on the telegraphs in 1912-13 was £1,175,347, and the surplus on the telephones in that year was £303,343.

Submarine Telephones.—A demonstration was given in London last week of a submarine telephone by Captain Louis Sorcho, an American inventor. The device enables a diver to maintain communication with the surface in spite of the noise in his helmet due to the roaring of the air supply and the pulsations of the pumps.

Telegrams in Code.—The Postmaster-General has given permission for the use of the authorised codes for telegrams to Brazil and French Guiana; the only South American country still excluded is Dutch Guiana.

Turkey.—It is reported that all English and French telephone employés in Constantinople have been replaced by Hungarians. The telephone service has been placed in the charge of an Austrian, and the telegraph service have been taken over by a Hungarian.

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot.—April 20th. U.D.C. One 400-KW. D.C. turbine set, complete with surface condenser and circulating pumps, &c. One water-tube boiler with chain-grate stoker. See "Official Notices" March 26th.

May 4th. Steam and other pipework. Water-softening plant. See "Official Notices" March 26th.

Australia.—MELBOURNE.—April 19th. 13,560 yards of lead-covered cable, and 13 tons of bare hard-drawn copper cable, for the City Council. See "Official Notices" March 26th.

April 21st. 1,027,900 arc lamp carbons, for the Melbourne City Council. See "Official Notices" to-day.

May 19th. Electric signals and spare parts (Contract 28,591), track transformers (Contract 28,359), electric train stops (Contract 28,590), all for a period of five years. Particulars at Contractors' Room, Spencer Street.*

May 19th.—Machine tools and equipment, and sprinkler, for the Melbourne, Brunswick and Coburg Tramways Trust. Specifications, &c., £2 2s. each, from the Engineer's office, Sydney Road, Coburg.

June 2nd. Electric lighting material for cars (Contract 28,187). Tender box, Railway Offices, Melbourne. Particulars at Contractors' Room, Spencer Street.* Deposit ½ per cent. of amount of tender.

June 2nd. Bogie trucks, wheels and axles for 10 cars of the St. Kilda-Brighton electric street railway (No. 28,621) for the Victorian Railway Commissioners.*

June 15th. Four mechanically-fired boilers, for the City Council. Specifications (£1 1s.) from the City Electrical Engineer.

QUEENSLAND.—June 1st (instead of March 16th). P.M.G. Switchboard for Warwick. See "Official Notices" March 26th.

SYDNEY.—May 31st. Three electric battery locomotives for new public abattoirs, Homebush, for the Public Works Department.

Specifications for the items marked * can be seen at the B. of T. Commercial Intelligence Branch in London.

Basingstoke. — April 19th. Corporation. Diesel engine generating set, motor-generator, balancer, underground cables. See "Official Notices" to-day.

Bradford.—April 17th. (A) 100 tramcar trucks, (B) 200 motors, 200 controllers, 200 automatic circuit breakers, for the Tramway Department. Specifications (A and B) one guinea each, from Tramway Offices, 7, Hall Ings.

Brighton.—April 12th. Corporation. Surface condenser. See "Official Notices" March 26th.

Bristol.—April 14th. Incandescent electric lamps (from local firms or from firms in a position to supply from local stocks), for the Docks Committee of the T.C., from May 1st to August 31st. Mr. T. A. Peace, Engineer.

Darlington.—April 20th. Corporation. 25-ton overhead traveller and economiser. See "Official Notices" to-day.

Dundee. — April 28th. Corporation. Centrifugal circulating pumps, and 750 ft. of 42-in. and 30-in. cast-iron pipes. See "Official Notices" to-day.

Edinburgh.—Offers are wanted for upholding house telephone and electric bell installations throughout the city properties. Superintendent of Works, City Chambers.

Offers are also wanted to supply electrical material for interior wiring and jointing, and insulating material for electricity supply cables. Resident Electrical Engineer, Dewar Place.

Glasgow.—April 16th. Corporation. Cables, meters, carbons. See "Official Notices" to-day.

April 13th. Corporation. Six or twelve months' supply of V.I.R. cables, for the Tramways Department. Specifications from Mr. J. Dalrymple, General Manager, 46, Bath Street.

London.—SOUTHWARK.—April 14th. Cable and meters, for the Borough Council. See "Official Notices" April 2nd.

Mountain Ash. — April 26th. U.D.C. Sub-station building, E.H.T. underground cables, L.T. overhead lines and public lighting, E.H.T. switchgear, L.T. switchgear and transformers, for Aberoynon. See "Official Notices" to-day.

Manchester.—April 14th. Corporation. Three 1,250-K.V.A. static transformers. See "Official Notices" April 2nd.

Rhondda.—April 17th. U.D.C. Installation, 83 wiring points, 88 lighting points, at the Council Offices, Pentre. See "Official Notices" April 2nd.

Sheffield.—April 12th. Supply of motor-van (petrol or electric) to carry one ton, for the Corporation. Specification (10s.) from the Cleansing Superintendent, Town Hall.

CLOSED.

Australia.—The Prahran and Malvern Tramways Trust has accepted the following contracts:—

Contract No. 61 (booster and switch gear), Messrs. Noyes Bros. Pty., Ltd., Melbourne, £920.
Contract No. 62 (battery), Messrs. Elder, Smith & Co., Ltd., £2,317.

Batley.—The Corporation has accepted the following tenders:—

Brush Electrical Engineering Co., Ltd.—Transformers.
British Thomson-Houston Co., Ltd.—Switchgear.

Burton-on-Trent. — Two stokers and self-cleaning compressed-air furnaces have been ordered from Messrs. Ed. Bennis and Co., Ltd., for the Corporation electricity station. This is a repeat order.

Croydon.—The tender of Messrs. Callender's Cable and Construction Co. has been accepted by the Council for 12 months' supply of cables. The contract will provide for payment on a sliding scale based upon the market price of copper.

Dudley.—The Lighting Committee has accepted the tender of the Earl of Dudley, for a 12 months' supply of steam coal, at 17s. 6d. per ton.

Gillingham (Kent).—The T.C. has accepted the tender of Messrs. Spencer, Whatley, Ltd., for 300 tons of Nottingham slack (through about 2-in. screens), for the electricity works, at £1 3s. per ton; and if the whole of this cannot be supplied, to obtain the remainder from Messrs. Myers, Rose & Co., at £1 3s. 6d. per ton.

Glasgow.—The Electricity Committee has recommended for acceptance the offer of Messrs. John Bennie, Ltd., at £323, for the erection of an electric hoist in the premises of Messrs. Burton, Son & Sanders, Ltd., Kinning Park.

Grimsby.—The Public Lighting Committee of the Town Council has accepted the tender of Messrs. Johnson and Phillips, Ltd., at £296 10s., for a supply of cable.

Halifax.—The B. of G. has accepted the tender of the Gath Electrical Engineering Co. for electrical fittings.

Huddersfield.—An order has been placed with Messrs. Edward Bennis & Co., Ltd., for four pairs of chain-grate stokers, each grate 4 ft. 3 in. by 12 ft. 4½ in. centres, for Sterling water-tube boilers, for the Corporation electricity works.

Ilford.—The U.D.C. has made a contract with the British Thomson-Houston Co., Ltd., for 12 months' supply of their electricity meters.

Leyton.—The Education Committee has accepted the tender of Messrs. E. H. Grimshaw & Sons and Mr. H. H. Taylor for carrying out electric light repairs to the various schools in the district during the ensuing 12 months.

Liverpool.—The Electricity Committee proposes to accept the tender of Messrs. Babcock & Wilcox, Ltd., for three water-tube boilers and accessories, with coal and ash-handling plant, &c., for the Lister Drive power station; also the tender of Messrs. E. Green & Son, Ltd., for three economisers and accessories. The Committee also proposes to accept the following tenders for annual supplies to the Tramways Department:—

Lubricating oils and greases.—Vacuum Oil Co., Ltd.; Matthew, Wells and Co., Ltd.

And the following for similar supplies to the Electricity Department:—

Lubricating oils.—Vacuum Oil Co., Ltd.; Henry Wells Oil Co., Ltd.
Electric fittings and sundries.—Sykes & Sugden, Ltd., 10 items; B.I. and Helsby Cables, Ltd., seven items; British Electric Calibrated Fuse Co., one item; Simplex Conduits, Ltd., 11 items.

The tender of the Staveley Coal and Iron Co., Ltd., has been accepted for the supply of cast-iron circulating water pipes to the Lister Drive power station.

London.—War Office.—A contract for one 300-B.H.P. Hick-Diesel engine has been placed with Messrs. Hick-Diesel Oil Engines, Ltd.

L.C.C.—The Education Committee has accepted the tender of the Lancashire Dynamo & Motor Co., Ltd., at £36 10s., for a 5-H.P. electric motor for driving the various machines at the Shoreditch Technical Institute.

Manchester.—The Education Committee has accepted the tender of Messrs. R. Seddon & Sons for electric lighting at the Alice Briggs Home.

The following tenders have been accepted by the Electricity Committee:—

Six superheaters.—Heenan & Froude, Ltd.
Two low-pressure circulating water pumps.—Gwynnes, Ltd.
Three reactance coils.—Siemens Bros. Dynamo Works, Ltd.
Cable.—Siemens Bros. & Co., Ltd.

The Sanitary Committee has accepted the tender of Messrs. Maitland & Co. for the electric lighting at the new ward pavilions at Monsall Hospital.

Meter Contracts.—Messrs. Ferranti, Ltd., have recently obtained contracts as follows for meters, the contract in each case being for the year ending March, 1916:—

Bristol Corporation, C.C. meters.
Croydon Corporation, C.C. and A.C. prepayment meters.
Hammersmith Borough Council, A.C. prepayment meters.
Ilford District Council, C.C. meters.
Londonderry Corporation, C.C. meters.
Plymouth Corporation, A.C. meters.
Whitehaven Corporation, C.C. meters.

Nuneaton.—The tender of Mr. George Smith has been accepted by the Council for the supply, during the ensuing 12 months, of 2,000 tons Ansley Hall Smudge coal, at 6s. 9d. per ton, to the electricity works.

Richmond-on-Thames.—The Richmond, Heston and Isleworth Joint Hospital Board has accepted the tender of Mr. D. J. MacDonald, of Hounslow, for maintenance of the electrical installation at the hospital.

Salford.—Messrs. Siemens Bros. Dynamo Works, Ltd., have again secured the contract for the annual supply of Wotan, tantalum, and carbon-filament lamps to the Corporation Tramways Department.

The following tenders have been accepted for the purchase of scrap metal at the electricity station:—

S. Openshaw.—Old arc lamps, approx. value of contract, £34.
J. H. Broomhead.—Heavy cast-iron, light wrought-iron and heavy wrought steel, £13 4s.
J. Livesey.—Copper, lead and light brass, £367 7s. 6d.
J. E. Peach & Sons.—Heavy brass, burnt cast-iron and rubber, £46 10s.
T. Mitchell & Sons, Ltd.—Motor-driven boiler feed pump, £40.
S. Openshaw.—Steam feed-water heater, £5.
A. Learoyd.—Battery of accumulators, about 90 tons disused accumulator plates, connecting bars, &c., wood stillages, glass and porcelain insulators, battery booster and switchgear, and two balancers and switchgear, £706.
T. Mitchell & Sons.—Seven old electric motors, £49.

The following tenders have also been accepted:—

Pendleton Ironworks Co.—Steel work for car depôt extension, £1,480.
Hadfield's, Ltd.—Axles, wheel tires and wheel centres, £1,188.

Walthamstow.—The U.D.C. has renewed its contract for the next 12 months for S.P. and D.P. 5 and 10-amp. tumbler switches, with Messrs. J. H. Tucker & Co.

Walton-on-Thames.—Messrs. R. Langston-Jones & Co. have secured the contract for the lighting and equipment for the new cinema for the Walton-on-Thames Cinema Co., Ltd., at £251.

Watford.—The Electrical Apparatus Co. have withdrawn their previous tender for 200 meters, and the electrical engineer has been authorised to purchase the same number from the firm at the scheduled prices, to be taken when required during a period of two years. The tender of the British Westinghouse Co. has been accepted for the supply of 350 larger size meters at scheduled prices, to be supplied over a period of two years also.

The Electricity Committee has refused to grant a request from Messrs. Cory & Son, Ltd., for an increase in the price of coal under contract.

FORTHCOMING EVENTS.

Association of Engineers-in-Charge.—Saturday, April 10th. Social and Dance.
Wednesday, April 14th. At 7.30 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "Autogenous Welding," by Mr. L. M. Fox.

North of England Institute of Mining and Mechanical Engineers.—Saturday, April 10th. At 2 p.m. At Wood Memorial Hall, Newcastle. Discussion on various papers.

Royal Institution of Great Britain.—Monday, April 12th. At 5 p.m. At Albemarle Street, W. General Meeting.

Institution of Civil Engineers.—Tuesday, April 13th. At 8 p.m. At Great George Street, S.W. Paper on "Impact Coefficients for Railway Girders," by Mr. C. W. Anderson.

Institution of Electrical Engineers.—Thursday, April 15th. At 8 p.m. At Victoria Embankment, W.C. Paper on "The Power Supply of the Central Mining—Rand Mines Group," by Mr. J. H. Rider.

(**Manchester Local Section**).—Tuesday, April 13th. At 7.30 p.m. At Engineers' Club, 17, Albert Square. Mr. Rider's paper as above.

(**Scottish Local Section**).—Tuesday, April 13th. At 8 p.m. At 207, Bath Street, Glasgow. Annual General Meeting. Paper on "Power Plant Testing," by Mr. W. M. Selvey.

(**Students' Section**).—Wednesday, April 14th. At 7.30 p.m. At Victoria Embankment, W.C. Paper on "The Electric Drive of Rolling Mills," by Mr. J. M. Heslop.

(**Birmingham Local Section**).—Wednesday, April 14th. At 7.30 p.m. At University, Edmund Street. Paper on "The Power Supply of the Central Mining—Rand Mines Group," by Mr. J. H. Rider.

(**Yorkshire Local Section**).—Wednesday, April 14th. At 7 p.m. At the Philosophical Hall, Leeds. Paper on "Good Lighting and its Immediate Effects from the Economic Standpoint," by Mr. V. H. Mackinney.

Institution of Mechanical Engineers.—Friday, April 16th. At 8 p.m. At Storey's Gate, S.W. Ordinary General Meeting.

NOTES.

Inquiries.—We are asked for information regarding "the heating of veneer plates by the so-called Hot Press System," for an important Canadian authority. Makers of the "Omnimeter" slide rule are asked for.

For Sale.—Messrs. P. Huddleston & Co. are instructed to sell by auction the cable, wire and fittings used for lighting the Liverpool Exhibition. Particulars are given in our advertisement pages to-day.

An Echo of the Building Strike.—In October, 1913, the London Education Committee accepted the tender of Messrs. Arthur Newman, Ltd., at £460, for installing electric light at the Middle Row School, Kensington. The school is being rebuilt in sections, and the first portion of the electrical work is now finished, the value being £213. Messrs. Newman have asked the Committee for an allowance in respect of the time which elapsed between the signing of the contract and the commencement of the work. The delay was caused owing to the strike in the building trade last year. The responsible Sub-Committee is of opinion that a payment of £6 2s. would be a fair and reasonable settlement of the claim, and has recommended the Committee accordingly.

The I.E.E. Benevolent Fund: An Appeal.—We commend to the sympathetic interest and generous support of our readers the appeal that has been issued by Sir John Snell, the President, on behalf of the Institution's Benevolent Fund. Sir John says:—

"The Committee of Management have before them three urgent cases which it is felt should be dealt with by the brother members of those whose families are in need of help.

"There is one case of a member who died recently while on his way abroad to take up a very good position, whose widow and two children must be assisted by some charitable organisation. Another case is that of a member who was injured in an accident and is now mentally incapable of earning any livelihood, and whose wife and four children are penniless. And there is yet a third case of three maiden ladies, the daughters of a deceased distinguished member, whose age and health make them incapable of earning anything towards their subsistence.

"In all these cases there are no relatives able to assist. The Committee, therefore, feel that each of these cases properly falls within the scope of the Benevolent Fund. There are in addition other cases of members and of families of members who are in receipt of assistance from the Fund, and it is anticipated that further deserving cases will in the near future come before the Committee. For an Institution of the size and importance of ours, a Benevolent Fund, which has been in existence for some 25 years, ought to have a larger accumulated capital than £4,640, and a larger income from investments than £175 per annum. During the year 1914 the annual subscriptions from members amounted to £87 only, and donations of single sums amounted to £93, that is, a total of £180, which is considerably less than could fairly be expected from an Institution of over 7,000 members. During this period of war, the positions and incomes of the majority of the members of the Institution have been only very slightly affected; and I venture to hope that a ready response will be made to my appeal to increase the resources of the Benevolent Fund, in order to enable the Committee to relieve the distressed and to assist the dependents of those of our members who have fallen by the way, as the amount at the disposal of the Committee is at present entirely insufficient to meet adequately the demands made upon it."

Fatality.—Langley.—At the inquest on the death of a labourer named Wilcox, aged 17 years, referred to in our last issue, evidence was given by Mr. John Legge, chief engineer of the Shropshire, Worcestershire and Staffordshire Electric Power Co., Ltd., to whom the wires belonged. He said that the War Office requested the company a fortnight ago to start immediately to get a supply of electricity to the site of the new Government works at Langley, which is near Albright & Wilson's works, to enable the men to work night and day. The nearest point from which they could get a supply was at Messrs. Albright & Wilson's works, and the firm permitted them to connect up from their transformer to the new works. The wires were carried on the top of a wall, the lowest wire being 10½ ft. from the ground, and they were considered to be perfectly safe. It was only a temporary arrangement, and, as soon as the underground cable was laid, the existing wires would be done away with. The voltage of one wire was 270, but if Wilcox caught hold of both wires he would probably receive a shock of about 500 volts. The jury returned a verdict of "Accidental death," and added the opinion that the wires were in a dangerous position. Though the wires were only there temporarily, they thought they should have been in some way protected.

Institution and Lecture Notes.—Royal Institution.—The following arrangements are announced:—

Friday, May 7th, at 9 p.m., Prof. O. W. Richardson, "Electrons and Heat" (experimental).
" " 28th, at 9 p.m., Sir John Jackson, "Engineering Problems of Mesopotamia and Euphrates Valley."
" June 4th, at 9 p.m., Prof. Sir E. Rutherford, "Radiations from Exploding Atoms."

Afternoon meetings (3 o'clock):—

Saturday, May 15th, and Tuesday, May 18th. Prof. Fredk. Soddy, "Advances in the Study of Radio-active Bodies."
Tuesdays, June 1st and 8th, Prof. J. O. Arnold, "The Evolution of Steel: Influence on Civilisation."
Thursdays, April 29th and May 6th, Prof. A. W. Porter, "Advances in General Physics."
Saturdays, May 1st and 8th, Prof. J. A. Fleming, "Photo-Electricity" (experimental).

Institution of Electrical Engineers.—At the meeting of the Birmingham Local Section on Wednesday last a paper was read by Mr. W. C. Acfield on "Development of Main-Line Signalling on Railways," and a discussion followed.

Greenock Electrical Society.—At the last meeting a paper was read by Mr. L. Hogg on "Mains."

The following office-bearers were elected for next session:—Hon. president, Mr. Frank H. Whysall; president, Mr. W. B. Smith; vice-presidents, Messrs. Duncan Angus and Samuel James; secretary, Mr. H. G. Wright; treasurer, Mr. Wm. M'Gibbon.

Appointments Vacant.—Engine driver-stoker (30s.), two switchboard attendants (20s.), jointer, meter fixer and reader (35s.), for Ilkley U.D.C.; car-shed superintendent (£200), for Bolton Tramways Department; switchboard attendant (25s.), for Kingston-upon-Hull Corporation; working permanent-way foreman (42s. 6d.), for Burton and Ashby Light Railways. Particulars are given in our advertisement pages.

How to Sell.—The Sales Managers' Association has arranged for to-night, Friday, at 7.30 p.m., a meeting to which "every British Business Man" is invited. There will be an address by Mr. C. Hamilton Wickes, H.M. Trade Commissioner in Canada, on "How to Market British Goods Abroad." Mr. Wickes holds that it is not in the quality of the goods that England is at a disadvantage in the industrial race for the world's markets, but in the methods adopted for making sales. We have no doubt that the meeting will prove a profitable one to all of our readers who can attend at this short notice. The announcement was only issued to us under date *April 1st*, and, of course, was not received by us until after the holidays. It is regrettable that an Association which aims at the improvement of our methods should not have issued a little longer notice of its arrangements—the eve of Good Friday was a particularly unfortunate date to choose for its circulation. We hope, however, that this reference to the matter will make an added impression upon the minds of our busy commercial readers, and will ensure a good sprinkling of electrical men among the audience at the King's Hall, Holborn Restaurant, to-night.

Fire at Dunston.—A fire occurred on April 5th at the Dunston electric power station of the Newcastle-on-Tyne Electric Supply Co., Ltd. An extension of the premises has recently been completed, and some new turbo-generators have been installed, and it was in this section of the works that the outbreak occurred. For some time there were apprehensions of the fire seriously extending, but the work of the employés, aided by the military on duty in the neighbourhood, proved sufficient to limit the trouble. The damage done was said to be considerable, but fortunately the supply was not affected by the accident. One of the employés was rather seriously burned.

Engineer Volunteer Training Corps.—It has been suggested to the President of the Institution of Electrical Engineers, Sir John Snell, by General Sir O'Moore Creagh, V.C., Military Adviser to the Central Association of Volunteer Training Corps, that an Engineer Volunteer Corps should be raised from members of the engineering profession who are either above military age, or who, being of military age, are prevented by some good reason from serving in the Regular or Territorial Forces.

The objects of the corps would be to train men of military age to make them useful Royal Engineers recruits if and when they are able to enlist, and to furnish engineer units to assist in the completion of the volunteer organisation. The units would be so constituted as to ensure that the maximum advantage would be taken of the specialised skill of their members.

Instruction and training will be given in military engineering, with special reference to field and fortress work (including telegraphs, telephones, searchlights, &c.), in addition to drill, musketry and other military operations proper to an engineer unit. Drills will be arranged so that each unit will receive instruction for at least two hours per week in the evening and on Saturday afternoons or Sundays.

The corps will be affiliated to the Central Association, and all the conditions contained in the War Office letter to Lord Desborough dated November 19th, 1914, will be observed. Members joining will be required to provide their own uniforms, and probably some part of the equipment.

The Institution has addressed a circular on these lines in the first instance to members residing in the London area. The question of forming similar corps for members residing outside this area will be considered at a later date.

Copper.—The European visible supply at the end of March was 29,056 tons, a decrease of 5,319 tons during the month. From Messrs. H. R. Merton's tabulated statistics we find that English supplies diminished by 698 tons during the same period. In dealing with the former figure (European supplies), however, it will be noted that the figure given for French stocks at the end of February was based on the stock before the war, while that now issued is in accordance with official figures. The figures for enemy stocks are still, of course, conjectural. Figures of supplies from various sources show American arrivals in Europe largely in excess of any month since last July. The quantity received by England and France from Spain and Portugal during March, 1915, was well over the pre-war average, and the figure for supply from "other countries" was 7,178 tons, nearly half as much again as the pre-war average. Chile shipments were 10 per cent. under the pre-war average, and Australian about ¼ below. Total supplies very considerably exceed those for any month since the war started, and are 4,358 tons above the supplies for January, 1914.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Wimbledon T.C. has been recommended to appoint Mr. H. Oswald as an engineer-in-charge at the electricity works at a salary of £104 a year, rising to £156 by annual increments of £13.

The marriage took place at Oldham on March 24th of Mr. Wm. Chamberlain, one of the joint managers of the Oldham Corporation electricity department, and Miss Lilian Hood, daughter of the late Alderman John Hood, J.P., a former Mayor of Oldham.

Mr. H. A. Histed, of Croydon, has been appointed meter inspector at the Watford electricity works. Mr. T. W. Turner, assistant mains superintendent, has resigned his appointment.

Mr. W. L. Chubb, chief assistant at the Horsham electricity works, has resigned, having been appointed to a similar post at Stafford.

Tramway Officials. — Mr. Frederick Taylor, carshed superintendent at Bolton, has resigned, and applications are to be invited for the vacancy, the salary offered being £200 per annum.

General.—The staff of the offices of the British Insulated & Helsby Cables, Ltd., Helsby, have presented a case of cutlery, suitably inscribed, to Mr. Ernest Barker, of Runcorn, a member of the office staff, upon the occasion of his marriage. The presentation was made by Mr. G. Seddon, the cashier.

Mr. Oscar C. Waygood, of the transformer department of the British Westinghouse Works at Trafford Park, was married at Levenshulme Congregational Church at Easter, to Miss Lily Myers, only daughter of Mr. and Mrs. W. H. Linton, Victoria Park, Manchester.

Mr. H. C. Walker, chairman and joint managing director of Waygood-Otis, Ltd., lift and crane makers, on completing half-a-century's connection with the company, has been presented by the staff and employés with a grandfather clock and a morocco bound album, containing the signatures of 600 employés, and the names of 250 members of the staff who have joined the services.

Mr. James G. Lorrain has changed his address to 9, John Street, Adelphi, London, W.C.

Obituary.—Dr. H. Lewis Jones.—We deeply regret to learn of the death, which occurred on Sunday last at his residence in Harley Street, of Dr. Henry Lewis Jones, M.A., M.D. Camb., F.R.C.P., London. For many years Dr. Lewis Jones had been one of our foremost authorities on medical electricity, indeed as long ago as February, 1893, he appeared among other experts on the side of the Electrical Review in the litigation which followed upon its attacks on a certain extensive electric belt business. The very responsible position which he occupied at St. Bartholomew's Hospital afforded him ample scope for the exercise of his specialised knowledge and experience, and gave him exceptional opportunity for adding thereto. For a lengthy period he was medical officer in charge of the electrical department at that Hospital, and we believe that he was responsible for the electrical equipment there being so efficient and complete. During the last year or two he had been connected with the same department in a less active capacity, as consulting medical officer. His position as a recognised authority on electro-therapeutical and electro-medical subjects brought him into prominence as an author in a department which has too few authoritative exponents, and he occupied the presidential chair of the British Electro-Therapeutic Society in 1903 and 1904. He was an Associate of the Institution of Electrical Engineers, and in 1900 read a paper before that body "On the Applications of Electricity in Medical and Surgical Practice." Other writings of his within our recollection dealt with "Lethal Effects of Electrical Currents" (*British Medical Journal*, 1895); "Electrical Treatment of Infantile Paralysis" (Medical Society of London, 1894); and "The Duration of Discharges of Induction Coils." He was also the author of a well-known work on "Medical Electricity," based on the original work by the late Dr. Steavenson, of St. Bartholomew's, which went through many editions. Dr. H. Lewis Jones, who has passed away at the comparatively early age of 58, was a gentleman with whom it was a pleasure to have relations, and one who could not be known without being esteemed; his passing leaves a blank in an important department of Science, and he was an authority whom we could ill afford to lose.

Sir J. C. Lamb.—We regret to record that Sir John Cameron Lamb, formerly Second Secretary to the Post Office, died on March 30th at his residence at Hampstead. In the course of a lengthy account of his career appearing in the *Times*, it is stated that Sir John, who was born in 1845, entered the Post Office in 1864, and he retired in 1905, after more than 40 years' service. He at first served in the Receiver and Accountant-General's Department, but in 1870 he was selected with others to assist in negotiations for the acquisition of the inland telegraphs, which up to that date had been entirely in the hands of private companies. Mr. Lamb took a prominent part in the organisation of the acquired telegraph systems and their extension to meet the growing requirements of the public. In 1888 he carried out most of the arrangements in connection with the introduction of 6d. telegrams. A rapid development in the international telegraph system has taken place since 1870, and many questions affecting the control of the cables laid by British companies and the relations with foreign telegraph administrations were continually arising for settlement, and Mr. Lamb took a large part in the arrangement of these matters. In 1886 he was one of three delegates appointed by the Secretary of State for Foreign Affairs to attend an international conference in Paris on the protection of submarine cables, and he subsequently served as a member of the Commission appointed to examine the laws of the various countries bearing on the subject. In 1884 and again in 1888 Mr. Lamb attended conferences with the officials of various telegraph administrations, and negotiated agreements for the joint acquisition and working of the Continental cables. These arrangements, which were carried into effect in 1889, resulted in the purchase of the cables from the Submarine Telegraph Co. Mr. Lamb took part in three international telegraph conferences—in 1890 in Paris, in 1896 at Buda-Pesth, and in 1903 in London. At the Paris and Buda-Pest conferences he was the senior British delegate, and at the London conference was elected president. In 1903 he was the senior British delegate at the first International Conference on Wireless Telegraphy held in Berlin. In 1895 Mr. Lamb negotiated the purchase of the telephone trunk lines connecting the various centres, and organised a State system extending to the principal towns in England, Scotland and Ireland, and also to Paris. Mr. Lamb was appointed third secretary of the Post Office in 1896, and in the following year became second secretary. He took a leading part in discussions upon the policy which should govern the relations of the Post Office to the National Telephone Co. and the municipalities in connection with the telephone service, and gave evidence before a Select Committee of the House of Commons in 1898. From 1892 to 1897 he served as a member of the Royal Commission appointed to consider the establishment of electrical communication with lighthouses and light-ships. He received the C.M.G. in 1890, the C.B. in 1895, and a knighthood on his retirement.

Mr. R. Tuke.—The death occurred on April 4th, at the age of 57 years, of Mr. Richard Tuke, Chief Superintendent of Telegraphs at the Leeds Post Office. He joined the telegraph service in Leeds in 1873, and passed through all the successive grades to the post of chief superintendent, to which position he was appointed only last year. His death was quite unexpected, for he attended to his duties as recently as March 27th.

CITY NOTES.

Cork Electric Tramways and Lighting Co., Ltd.

The directors' report for 1914 states that the revenue was £61,604, and the expenses were £37,958. Including £1,352 brought forward, there remains £24,998, less interest on debentures £4,600, leaving a balance of £20,398. Of this amount dividends on the 5 per cent. cum. pref. shares absorbed £6,163, £6,500 had been added to reserve for depreciation and renewals, £1,804 had been written off several items, a 3 per cent. dividend on the ordinary shares requires £3,450, and £2,480 is to be carried forward. The lighting and power business again shows satisfactory progress, agreements for 161 connections being concluded during the year. The additional connections represent a total gain of 467 kw. as against 212 kw. in 1913. The revenue amounted to £61,604, an increase of £1,469. The lighting and power revenue was £1,509 in excess of the previous year and the traction revenue £140 less, the decrease being mainly due to the war. The other revenue items show an increase of £100. The expenses amounted to £37,958, as compared with £37,524 for the previous year. There was a reduction of £1,315 in traction and lighting expenses, mainly due to lower maintenance charges for permanent way and cables. Power expenses, on the other hand, were increased to the extent of £1,700, due partly to the increased output and partly to heavier maintenance charges for the plant. The general expenses show a small reduction. The capital expenditure during the year, amounting to £2,500, has been mainly for house services and additional plant for the power station. To meet the increasing demand for lighting and power the directors have ordered a 1,000 kw. direct-current geared Curtis turbine. In view of the substantial increase in the cost of coal and other materials, also wages, dues to the war, the directors may have to consider the question of increasing the charges for electricity.

The annual meeting was held yesterday.

	Traction.					Lighting and power.	
Year.	Miles open.	Passengers carried.	Average fare.	Car-mileage.	No. of cars.	No. of customers.	8-c p. lamps (equiv.) connected.
1912 ..	9·89	5,695,103	1·06d.	898,153	35	2,530	168,774
1913 ..	9·89	5,864,339	1·04d.	893,594	35	2,665	170,926
1914 ..	9·89	5,858,904	1·06d.	870,094	35	2,826	182,477

Clyde Valley Electrical Power Co.—The report states (says the *Financier*) that, after payment of the preference share dividend and adjusting interest and transferring £12,500 to contingency fund for depreciation, &c., there remains £33,826. The directors recommend that £3,290 be transferred to special reserve, £10,000 applied in writing down cost of accounts, and £9,000 provided for the dividend on the preference shares to April 30th, leaving £11,535 to be carried forward.

Lymington Electric Light and Power Co., Ltd.—The result of trading during 1914, including £769 brought forward, shows a profit to the credit of the net revenue account of £2,668, and after paying interest on debentures, amounting to £450, there is a balance of £2,218; £1,000 is to be placed to reserve account, and a dividend at the rate of 5 per cent. per annum paid on the preference shares, amounting to £321, leaving £897 to be carried forward. During the year the company have invested £1,000 in Colonial Government Stocks.

Oriental Telephone and Electric Co., Ltd.—Subject to audit, the directors recommend the following dividends:—At the rate of 6 per cent. per annum on the preference shares for the half-year ended December 31st last, less income-tax; a final dividend of 6 per cent. on the ordinary shares issued, free of income-tax, making a total of 10 per cent. for the year. The share transfer books will be closed from April 15th to 28th.

Brush Electrical Engineering Co., Ltd.

The annual meeting was held at 1, Kingsway, W.C., on March 29th. Mr. E. Garcke, who presided, congratulated the shareholders on the improved position of the company. The improvement which he was able to report at the last general meeting was fully maintained during the past year, notwithstanding the difficulties and the dislocation of business caused by the war, and the accounts showed that the company was again getting into a thoroughly sound position. Now that they had turned the corner and were making profits, he was able to confess that there were times during the last five or six years when the directors were very nearly despairing of being able to pull the company out of its difficulties, but there were two factors which sustained them, and which explained the success they had achieved. In the first place, they appreciated very much the patience shown by the stockholders and the confidence which they gave the directors, and in the second place the extraordinary efforts made by the managing director and the whole of the staff in their struggle against adversity, were such as inspired everyone with confidence in their ultimate success. During the past year they had completed the re-organisation of the share capital account, and the balance sheet was now free from all items of doubtful validity, and showed a balance of undivided profits which was not only substantial but real. They would be perfectly justified in declaring a moderate dividend on the ordinary stock, but although the directors would have derived much pleasure in paying a dividend, they thought and felt that war time was not a time for a company which had just emerged from a long period of depression to begin the payment of dividends. After the experience they had gained, therefore, they considered that, when the company resumed payment of dividends, it must be with the conviction that in the absence of altogether unforeseeable calamities they would be able to pay dividends regularly later. The uncertainty of war conditions did not provide a reliable basis for any such conviction, and, therefore, they must reluctantly ask the holders of the ordinary stock to exercise a little longer that high quality of patience which they had practised so long with such beneficent effects upon the fortunes of the company. They paid, of course, for the past year, as they had always done, the full interest upon the whole of the debenture stocks, and they also paid a further 4 per cent. for the year on the 6 per cent. second prior lien debenture stock, making 10 per cent. for the year. After dealing with the accounts, the Chairman said that with regard to their operations generally, they had naturally suffered by the falling away of orders during the latter part of the year under review, and they had also been, and were still, handicapped by the shortage of labour and the difficulty of getting raw materials. The latter were adverse factors which, he was afraid, were likely to continue during the war, and might even increase. On the declaration of war everyone's first instinct was to at once begin husbanding resources, and their order sheets for the first two or three months immediately following the declaration of war did not make satisfactory reading. However, as confidence was re-established, an improvement took place, and this was assisted by the Government orders which the company was able to secure. This improvement had continued, and they had no cause to complain of the volume of business obtained since the beginning of the current year. They took early steps to put their manufacturing facilities at the disposal of the Government, and at the present time a large proportion of their output was for material for Government service. They were building not only turbo-generating plant and other engineering and electrical machinery for this duty, but had also undertaken the construction of aeroplanes to standard and improved designs, and they hoped shortly to have the special department they had organised for this work in full swing. In common with other engineering firms, they had granted a substantial all-round increase of wages to their workmen, and they were now faced with a demand for a special war bonus. They fully recognised that the cost of living had gone up, and that the men were entitled to more when more was being earned, but these continued advances of wages were liable to hit the firms engaged in the heavy section of the electrical engineering industry very much, because their contracts were of a nature that often extended over many months, and as they had to engage to deliver their products at a fixed price, it was not possible to obtain relief in respect of higher wages paid as regarded work already in hand. He hoped the men's representatives would admit that these advances could not be permanent, for in the nature of things the present conditions could not be permanent. At their meeting last year he told them of the success of the new steam turbine they had taken up. He referred to the Ljungstrom turbine. He was glad to report that the experience they had since gained in every way justified their action in securing manufacturing rights for this invention. It had fully realised their expectations, and was now firmly established as the most economical turbine on the market, while at the same time its reliability in operation under severe conditions had been completely confirmed. The remarkable results obtained in the way of steam economy appealed strongly to all owners of electric power undertakings in situations where fuel was costly, and the orders in hand and in prospect had compelled the directors to face the problem of providing means for turning out the turbine, with its auxiliary equipment of generators, condensers and pumps, on a larger scale; and with labour-saving high-speed tools. Machine tools of this class were already on order, and some of them would have been installed before now if it were not for the fact that the tool makers were all very busy in turning out machinery for munitions of war. The progress made in exploiting the Ljungstrom turbine, satisfactory though it was, would have been still more marked in more normal times, as many municipalities, who were their principal customers for this class of plant, were holding up projected extensions in their power-houses in consequence of the present difficulty of obtaining the necessary Government sanction for expenditure. At this moment they had a considerable amount of business held up on this account, and he looked for a large demand for the turbine as soon as the existing restrictions were removed. On their rolling stock side the shops had, on the whole, been kept well employed. They were building a large number of cars for the L.C.C. tramways, and were finishing a line of steel carriages embodying many special and improved features for the Central London Railway. They were adapting and extending some of the workshops for the manufacture of aeroplanes, for which they had already important orders in hand. To meet the capital expenditure necessitated by these developments, they proposed, as soon as they required the money, and subject, of course, to the approval of the Treasury, to issue the balance of their prior lien participating second debenture stock. The exact amount of this stock available was £48,899, and it carried fixed interest at the rate of 6 per cent. per annum, and was entitled to a further 4 per cent. out of the net profits of the company available for dividend in any year. The Chairman added that over 20 per cent. of the company's men, including officers, had joined the Army and Navy, and the directors had joined in a scheme which had been propounded by the British Electrical Federation for assisting the dependents of the men.

Mr. B. S. Broadhurst seconded the motion.

An amendment that the meeting should stand adjourned for the purpose of enabling the directors to reconsider the accounts with a view to the payment of a small dividend on the ordinary shares was not seconded, and the motion for the adoption of the report was agreed to unanimously.

British Westinghouse Electric and Manufacturing Co., Ltd.

The 15th annual general meeting was held on March 29th at Hamilton House, Victoria Embankment, Mr. J. Annan Bryce, M.P., presiding. In moving the adoption of the report, the Chairman, after referring at some length to the balance sheet, said that the net profit was about £45,000 more than that of 1913. That excellent result was caused mainly by increased efficiency. They possessed a very able management and a first-rate staff, built up during years by the managing director, and actuated from top to bottom by a spirit of devotion to its work. While he congratulated them on the result of the year's working, he must utter a word of caution. In some of the newspaper comments on the accounts it was said that they seemed to have benefited by the war because they had earned a much larger profit. Although five months of war came within the period covered by the accounts, any such deduction was entirely wide of the truth. The profit of the year was almost entirely, if not entirely, derived from contracts entered into before the war; most of it, indeed, on contracts made in 1913. As a matter of fact, they had already suffered, and were likely to suffer still more, from the war, though its injurious effects were not apparent in the accounts of 1914. The net profit was just sufficient, if they had divided right up to the hilt, to have allowed a distribution of 15 per cent. on the preference capital. But in the opinion of the board it was much wiser, with the present uncertain outlook, to continue the policy of strengthening their resources by building up reserves. They had, accordingly, added £50,000 to general reserves, written £25,000 off goodwill, and carried forward a rather larger sum than last year. When they met last year he told them that up till that date the orders taken during the first three months of the year were about the same as for the corresponding period of 1913, but that there were signs of a slackening in trade. During the succeeding four months, the slackening became marked, and by the end of July their fresh orders for the year were 27 per cent. behind those during the first seven months of 1913. The comparison, however, was not quite fair to 1914, as in that period of 1913 they had taken a very large electrification order from the London & South Western Railway Co. The sudden outbreak of war in the beginning of August perturbed their industry, as it did all others. Happily, they were in a strong financial position and had no anxieties on that score, but trade being for the time paralysed it appeared necessary to shorten sail. Two alternatives presented themselves: either to reduce the staff, or to ask it to accept short time or reduced pay as the case might be. The former course they were reluctant to adopt, not only for their staff's sake, but for their own. They had a splendid personnel which had taken years to build up, and once dispersed it would have been difficult to reconstruct, so they took the other course. The staff without a murmur at once most loyally agreed. The clerical staff accepted reduced pay but continued to work full time, while the manual labour accepted short time. Things having settled down, a return to normal conditions of work and pay was made in a few weeks. As the autumn went on, the stoppage of business with Germany began to make itself felt and orders were given to them in replacement of cancelled German contracts. At the same time the War Office and

Admiralty, to whom they had offered their services at the outbreak of war, placed with them orders for various goods, and they also took sub-contracts from other firms to assist their deliveries. Owing to those causes the volume of orders, which at the end of July had been 27 per cent. behind, finished up at December 31st only 17 per cent. behind that of 1913. So far, therefore, as mere volume of business was concerned, the war had rather improved their position. The mere volume of orders taken in any year, or their character, did not affect in any considerable degree the profits of that year, but had an important effect on subsequent periods. The diminution of 17 per cent. in the orders of 1914 was therefore in itself serious, and had a still more serious aspect when they came to consider the conditions under which they were being executed. In this connection the effects of the war would be found to be very injurious indeed. The active recruiting of the autumn, and the increasing demand for war supplies of every kind, rapidly caused a shortage of labour, especially of skilled labour, which towards the end of the year became acute. Lancashire responded nobly to the call of patriotism, and their staff did not lag behind. By the end of 1914 about one-third of their men had joined the Colours, and they replaced them with great difficulty. But the labour difficulty was not the only evil effect due to the war. The Government work which, for various reasons, they thought it wise to take, was not in itself profitable, the material being furnished to them and their remuneration being based in most cases merely upon a small percentage on wages. There had been a rise of 10 to 12 per cent. in the cost of every material they used, while the enormous rise in freights had seriously affected the results of their contracts for foreign and export work, as well as making further business far more difficult. They would, of course, endeavour to meet present conditions, not only by increasing prices where possible, but by increased efficiency, and, apart from war conditions, he thought their prospects were favourable. Even now there was a fair amount of business offering, and when the war was over there ought to be a chance of securing a good proportion of the business heretofore done in Germany, as there was likely for some time after the war to be in many countries a prejudice against her, even if her industry was not so disorganised as to interfere with her supplying her former proportion of the trade. The report alluded to their acquisition of their American friends' interests in the French and Italian Westinghouse companies. He should explain that their interest in the Italian company was an indirect one through the French company, which held a large majority of the shares of the Italian company. Their friends, after the experience of a number of years, during which neither of those companies had paid a dividend, had come to the conclusion that it was impossible to exercise a proper supervision from the other side of the Atlantic, and in pursuance of this policy they had already transferred their interests in Russia to a local company. They expressed to this company their willingness to cede to it their French interests. They offered what appeared to be favourable terms, trusting from what they had seen of this company's operations that it would be able to make the business both in France and Italy profitable, in which case they would get a return through their large holding in the British company. The French company had a capital of £560,000, divided into 10,000,000 francs cumulative preference shares, of which the American interests owned 8,745,000, and 4,000,000 francs ordinary shares, of which they owned 2,876,700, these holdings in both classes amounting to 83 per cent. of the whole. The Italian company had a capital of £160,000, of which the French company owned 73 per cent. Their American friends had sold them their interest in the French company in exchange for their holdings in the Clyde Valley Electrical Power Co. and the Traction & Power Securities Co., Ltd., at the prices at which they stood on their books on December 31st, 1914, viz., £160,127. The transaction thus amounted to their buying the American interests in the preference shares above at about half their face value and getting their ordinary shares thrown in for nothing. They considered that the bargain was a good one for them. They had of late years had ample opportunity of seeing the working both of the French and Italian companies, and formed the opinion that their want of success hitherto had been due to conditions which they and their American friends were confident that they would be able to improve. By bringing the work of the two companies' engineering and selling establishments into co-ordination with their own, they would be able to avoid over-lapping in both departments, thus saving heavy expenses in development and other work. Both companies had factories well adapted for certain work, and by concentrating at Manchester other work which they had been attempting to do they would be able to add to the volume of their own standard manufactures. At the present moment ordinary electrical manufacture was completely suspended in France, and the works there were entirely taken up with Government contracts for munitions of war, which yielded a fair return; but when the war was over they would have a good chance of securing, in addition to their previous business, a portion of the large amount of electrical work hitherto supplied to France from Germany. The Italian company was busy with contracts for electric locomotives for the Italian Government, a class of business for which it had obtained an excellent reputation, and in Italy, too, there should be good prospects of obtaining a considerable share of the business hitherto done with Germany in ordinary electrical work. Both companies were financially sound, though the Italian company suffered from an inadequate working capital, a deficiency which they believed could be supplied at the close of the war by the French company from its own resources without making any demands upon this company. This company's control of the French company would give an important advantage in another way. Through it this company would obtain an entry into Switzerland, Belgium, Spain, Portugal and their respective colonies, business in which the French company had not developed. With regard to prospects of business generally after the war, they would not expect him to prophesy. As they knew, it was expected by most people that a great depression in trade would follow the close of the war. "The expenditure of the present belligerents alone cannot, if the war lasts only eighteen months, fall much short of 5,000 millions of pounds. Add to this the expenditures by neutrals due to the war, say, another 100 millions; the destruction of property certainly at least another 1,000 millions; the loss by non-creation of wealth from the labour of at least 12 millions of fighting men for eighteen months, at the low estimate of £50 per man, another 600 millions; and the permanent loss by non-creation of wealth, say, for four years from the death or disablement of, say, four millions of fighting men, another 1,000 millions, you get the appalling total of capital loss of, say, 8,000 millions of pounds. And this vast sum does not include anything for the diminished production of wealth caused by the diversion of immense bodies of labour, not only in the belligerent but in many neutral countries, from the production of wealth to the production of unproductive war supplies, or for the consequent disorganisation of industry. Nor does it include anything for the incalculable diminution in production which must follow from the death or enfeeblement by famine and disease of huge numbers of human beings in the war areas." It would certainly take the world a generation to recover from the effects of the war, and its purchasing power must be vastly lessened in the immediate future. But it did not follow that all industries would be equally affected. Those which were, like their own, concerned with the provision of more economical means of production and transport might even benefit, especially considering that so extensive a destruction of the older types of mechanical production might furnish an opportunity of reconstruction on modern lines. Up to the end of 1914, 1,366, or about one-third, of their staff in Manchester had joined the Army, and the number had risen on March 8th to about 1,500. Men had also joined from their London and district offices, and from their Russian and South African offices. Many of them were already at the front and had suffered wounds and death. All honour to the gallant fellows who were braving for their country's sake the horrors of winter warfare in the trenches. And their gratitude was due not only to those with the Colours, but to those who had remained behind to perform the no less honourable task of maintaining the country's industries. "The fight is not at the front alone." At the beginning of September a fund was formed to provide relief for the dependents of men joining the Army. To this fund the company contributed £100 weekly, and to it the staff had up till March 6th contributed £3,550. A system of regular daily instruction for apprentices had been started in a lecture-room fitted up for the purpose. Lectures were given by members of the staff, some of them foremen. Tutorial work by foremen broadened the instructor's own view and tended to create in him a greater interest in the progress and welfare of the boys. The school was open on the average 7½ hours every day, and 271 apprentices had received instruction. He was sure they would agree that this school was performing a most valuable work, and the thanks of the company were due to those who so unselfishly carried it on.

Mr. E. A. Goulding, M.P., seconded the motion.

Mr. H. W. Birks said that he thought the shareholders looked forward to the future with even greater confidence than the Chairman would seem to by the tone of his speech. The board had done so well in former years that he thought the report encouraged them to hope that their prosperity would continue in the future. He thought something might be done in the way of legislation by which companies like their own should not have to compete with foreigners when local authorities and the Government were giving out their contracts.

The Chairman, in reply, said he did not take a pessimistic view of the future for, as he had said, he thought that many companies were likely to be a great deal worse off than themselves. He thought, however, they must not expect that the accounts for the current year, and probably those for 1916, would be as good as those now before them. The labour difficulty was a very serious one, and he thought they had a great deal to thank the trade union leaders for in the way in which they had managed affairs during this trying time. With regard to legislation on the subject of contracts going abroad, there Mr. Birks raised the whole question of Free Trade or Protection, and he felt sure there was very little likelihood of any legislation on the point at the moment. He must say that since the war, owing to the dishonourable pretensions of Germany, he took quite a different view on that particular question to that which he previously held—not that he thought we ought to have Protection; but he would expect that the attitude of persons in this country towards Germans would be different from what it was before the war. He

detested the Prussians, but it must not be forgotten that the reason they had been so successful in capturing trade both in this country and in our Colonies was because they were willing to provide what the people wanted, whereas English manufacturers were in many instances too slow to adapt themselves to new conditions. Generally speaking, Government departments had given a preference to English contracts where possible, and he believed that when the war was over that attitude would be very much accentuated here, and especially in France and Russia.

The report was adopted.

Urban Electric Supply Co., Ltd.

Mr. P. D. Tuckett (Chairman) presided on March 31st, at Salisbury House, E.C., at the annual meeting. In moving the adoption of the report, the Chairman said that having regard to the exceptional conditions under which the business was conducted during the latter half of the year they might congratulate themselves on being able to present so satisfactory a report. Their profits were larger by some £4,000, out of which they were able to pay an additional 1 per cent. dividend on the preference shares, after meeting the increased interest and redemption charges, and after appropriating £10,904 to reserve for depreciation. A year ago the corresponding appropriation was £12,000, so that superficially they appeared to be now making a smaller reserve provision, but this was not really the case. The Cornwall company earned in respect of the past year a profit of £17,325, of which only £12,162 was brought into their profit and loss account. For 1912 and 1913 a portion of the reserve provision made in their accounts was earmarked to the Cornwall company, whereas on this occasion that company had made an independent reserve provision for the year of £4,000, so that if they added this £4,000 to the £10,904, which they proposed to set aside, the total provision made for depreciation this year was nearly £15,000, as compared with £12,000 a year ago. The capital expenditure for the year was £35,000, and this was met by the sale of £24,524 debenture stock and by utilising the reserve provision appropriated from revenue, the "amount due to contractors" being reduced by about £1,300. During the current year capital expenditure was likely to show a further reduction compared with recent years, although they might still have to spend something not far short of £30,000, for, in spite of the war, it was neither desirable nor possible entirely to shut off all capital expenditure. They were proposing shortly to make an issue of debenture stock of the Cornwall Power Co. It would be a 5 per cent. stock, of a particularly well secured character, inasmuch as a statutory company could only issue debenture stock to the extent of one-third of its paid-up capital, *i.e.*, to the extent of one-fourth of its capital assets. The company was doing remarkably well, having already in its third year of working earned a return in excess of 8 per cent. on its entire capital, or sufficient to cover the debenture interest more than five times over, and there was every promise of its continuing to make equally satisfactory progress as the business further developed. The proceeds of the issue would be applied in part to repaying the Urban company a portion of the advance which it had made to the Cornwall Co. The issue would probably require the Treasury's approval, and they had not yet secured this, but they did not anticipate that they would have any difficulty in doing so. Reverting to the balance sheet, the various revenue reserves, which amounted to less than £10,000 in 1911, when they reduced their capital, now stood at £73,445, before crediting the provision of £10,904, which they proposed to set aside in respect of the past year, and without taking into account £8,000 standing to the credit of the Cornwall company's reserve for depreciation. On the other hand, the capital reserve had been reduced by a further £9,394 in the process of giving effect to the object for which it was created, and following the same procedure as in previous years. They had connected during the year the equivalent of 76,200 33-watt lamps, or rather less than in the previous two years. Still, it was a most substantial and satisfactory addition of 10 per cent., and it was entirely owing to the war that the previous records were not exceeded, for the connections for the first half-year were considerably larger than those for the corresponding period of the previous year. As it was, the power connections exceeded those for 1913 by the equivalent of 3,704 lamps, the reduction being in the lighting connections, which were less by the equivalent of 10,328 lamps. The lighting connections represented an increase of 5 per cent., and the power connections an increase of 16 per cent. on the previous respective totals. The output for the past year increased by 2,060,571 units, from 22,034,983 to 24,095,554, an increase of rather more than 9 per cent., the lighting units having increased 6 per cent., and the power units 10 per cent. Of this output, the Cornwall company's proportion exceeded 16,000,000 units, and was sold at an average profit of .253d., or a trifle over a farthing per unit, whilst the remainder realised an average profit of 1.104d. per unit. It was interesting to compare these rates of profit with the estimated profit of 3d. per unit on which the original prospectus figures were based in 1901. They could not have a better illustration of the enormous changes which had taken place in the character and conditions of the business, owing to the introduction of the incandescent gas mantle, the creation of a heating load, and the enormous and altogether unforeseen development of the power load, for it was to these developments and to the increased efficiency of the plant rather than to any marked inadequacy of price that the difference in the figures were attributable. In illustration of the profitable character of power load at even so comparatively small a profit as a farthing per unit, where the conditions were favourable and the business was conducted with care and judgment, he might call their attention to the yield of over 8 per cent. on the entire capital invested in the Cornwall undertaking, whereas, of their other undertakings, after 10 or 12 years' working, Hawick and Grantham were the only two showing a yield of as much as 6 per cent., and in the case of Hawick the greater part of the load was power. Although none of these figures which he had given were unsatisfactory, there was, he thought, no doubt that they would have been still more satisfactory but for the war, for although they had derived some direct benefit from the war in the case of Hawick where, during the latter part of the year, the mills had been abnormally busy with large Government orders, and in the case of Grantham, where one of the large military camps had been established and was being supplied by them, the majority of their undertakings had, on the other hand, in varying degrees distinctly suffered from the various adverse influences resulting from the war, and he was very much afraid that some of these influences might be accentuated as the war proceeded, and even more markedly perhaps after the war, if it was unduly protracted. The Chairman dealt with the effects of the war on the towns of Dartmouth, Penzance, Berwick, Stanford, Godalming, Glossop and Camborne, where there were undertakings in which the company was interested, and also touched on the rise in the price of coal and other materials and the rise in wages for labour. Lastly, he said, not the least serious loss they had sustained had been in the inevitable disorganisation of their staff consequent upon a number of their men joining the Colours. Altogether they had lost rather more than 100 men, a number they could ill afford to spare from their by no means over adequately staffed stations, for theirs was a skilled business and this was no easy time to replace skilled men trained in their service. They were making good to the dependents of those who had gone any diminution in the pay they were previously receiving. Although they were bound to suffer to some extent, he saw no occasion for unnecessary depression. In spite of the war they had reached the stage when they were able to recommend the payment of the full preference dividend, and he did not anticipate that they would be unable to maintain it, but he did think that it might be somewhat longer than he had hoped before they would be in a position to resume the payment of an ordinary dividend. But, whatever effect the war might have on the immediate prospects of the business, it would not, he felt sure, affect its permanent prosperity or deprive them in due course of the fruits for which they had so long and so patiently laboured.

Sir Douglas Owen seconded the motion.

In reply to questions, the Chairman said he did not think it wise to state the price at present at which they hoped to make the Cornwall company's debenture issue.

The motion was carried.

Cleveland and Durham Electric Power, Ltd.

The annual meeting was held at Newcastle-on-Tyne on March 29th, Mr. James Falconer (Chairman), M.P., presiding. The Chairman said the gross profits for the year amounted to £36,838, and in considering that amount it was necessary to take into account the exceptional circumstances under which the business of the year had been carried out owing to the fact that a war was going on, and that many businesses had been upset by it during the latter part of the year. It had affected that company adversely. With regard to existing customers, in a good many cases there was a considerable diminution in the volume of their business, and not only that, there was not a steady diminution, for they had to keep themselves in a position to supply the full demands, although to a considerable extent their demands did not reach anything like the normal. The cost of production was, therefore, increased. In the coal and ironstone area, which they largely supplied, the volume of business had been very seriously affected by the diminution of the number of men available for the work. They had also increased cost of coal, and that to a substantial extent affected their business. Another additional cost was due to the delay of making connections which had been already contracted for; in some cases plant which ought to have been supplied from abroad, and other from engineering shops at home, could not be delivered because the shops had had to devote their attention to producing articles urgently needed for the war. For this and other reasons it was not possible to draw reliable comparisons between the state of their business for 1914 and the preceding corresponding periods. Under all the circumstances, he thought the gross profits were not unsatisfactory compared with what the directors, at least, thought might be their position when the war broke upon them. After providing for debenture interest, there was a net profit of £16,826, which, with the sum of £8,798 brought forward from the last account, gave them an available balance of £25,624. The directors had come to the conclusion that it was the right thing to pay a dividend of 4 per cent. on the preference shares amounting to £13,348, to transfer to depreciation and renewals £3,000, as

against £2,000 for the preceding year, and to apply £1,000 towards the reduction of the expenses of the issue of debentures, carrying forward £8,276. Referring to the work of the year, he said they had completed and connected up a very large supply to the Horden Colliery, and the plant was a complete success, demonstrating that electrical working could be established on a large basis in all departments of colliery working. As to future business, they had at the moment contracted for further connections to the extent of 9,000 H.P., and that included contracts with the Middlesbrough and Stockton Corporations. The company were making allowances to the men who had joined the Colours.

Mr. W. R. Armstrong seconded the report.

Mr. A. Gemmell said he was ready to admit that the directors had had difficulties to deal with, and he believed the directors to be honourable men, but honourable men were sometimes so ill-advised as to accept a wrong policy and had not always the courage to change their course. The Board of Trade auditor had said that he could not check certain figures. Although the Cleveland group consisted of three companies it comprised one business; but there was no audit of the business as a whole and inter-company transactions on a large scale could not be properly checked. When the control of Parliamentary undertakings could be acquired, as it had been by that company, without Parliamentary sanction, by buying shares in companies invested with Parliamentary powers, and when that control was exercised against the interests of consumers and of shareholders, the case was a strong one for drastic remedy.

Mr. Chipchase asked how much the company got for supplying current, and what was their income from investments. He was very doubtful whether they ought to pay a preference dividend this year. There were too many deferred charges or liabilities against the company, including the issue of the debentures. He referred to the question of depreciation and was doubtful whether they were writing off sufficient for this purpose. It seemed to him that the financial position of the company was not yet sound. During the past year the directors had spent £48,000 on capital charges, and it seemed that they would be faced with a further capital expenditure this year, although the directors were silent on that point. To what further expenditure were they committed? Did they think the financial position justified them in making further capital expenditure? Ought not their energies to be directed to getting the best possible out of their present plant. He thought their expenses were much more than they ought to be. Unless the directors could assure them that they were strongly of opinion that the dividend could safely be paid, he moved that it be not paid at all.

The Chairman said there was no point for him to reply to in Mr. Gemmell's speech. In reply to Mr. Chipchase, he said he was not quite sure that he could give all the details asked for from memory, but they had all been carefully considered by the directors. They had always refrained from giving figures with regard to their income from the supply of current, for the obvious reasons that they did not think it was the practice of companies like theirs to give figures that would show the price at which they were supplying the current to different consumers, or even the average price. His own view of the company was that he thought that the time had arrived when it was desirable, and he thought they were fairly entitled, to accept a somewhat higher price than in the past for current supplied. In regard to the question of dividend, he thought that when the preferred shareholders had agreed to accept a dividend which was not cumulative the fair way in which to approach the question of paying a dividend to preferred shareholders was to see what was the profit of any particular year, after making proper allowances. Every legitimate consideration had been taken into account by the directors, and they had come to the conclusion that the right course was to make a payment of 4 per cent., recognising their responsibility in making it. As to further capital commitments, the directors had had in view for some time the importance of limiting so far as possible the capital commitments. There had been no avoidable expense incurred in the way of looking out for new business.

The report and statement of accounts was adopted.

The Chairman moved the payment of the preference dividend and the Hon. Robert James seconded.

Mr. Chipchase proposed that no dividend be paid this year, and Mr. Gemmell seconded, but the amendment was lost, and the motion was agreed to.

Launceston and District Electric Supply Co., Ltd.

The annual meeting was held on March 29th, Mr. R. B. Rogers presiding. The report showed that the business had grown satisfactorily, and that the number of customers at the end of the year was 188, and lamps 5,020. The revenue receipts amounted to £1,130, and the working expenses to £685, leaving a gross profit of £445. The number of units distributed during the year was 50,329. The Chairman said the company were appealing against the assessment as to rates, and they believed they would get it reduced. As to the business, while it was proceeding satisfactorily, he would like to see an increase in the supply of small motors. Mr. W. H. Symons (Vice-Chairman), in seconding the motion, referred to the decrease in working expenses. The town lighting had been approved by the Corporation, and the question of extending the mains was under consideration. He paid a tribute to the Engineer (Mr. Oxenham) for his tact and careful management. The report was adopted and a dividend of 2½ per cent. agreed to.

A vote of thanks was accorded to the directors and staff, special mention being made of the services of the Secretary (Mr. F. Benoy).

Woking Electric Supply Co., Ltd.

The report for 1914, which was adopted at the annual meeting held on March 20th, states that the revenue was £19,292, and the expenses for generation, distribution and management were £10,415, leaving £8,876, plus £622 brought forward and £132 for income tax accumulations. Interest on debenture stock absorbed £2,471, interest on temporary loans £369, dividend on the 6 per cent. cum. pref. shares £2,846, leaving £3,945, out of which £1,500 is placed to depreciation and renewals fund, £500 to reserve, 5 per cent. is paid on the ordinary shares, and £653 is carried forward.

	No. of consumers.	Lamps connected.	Revenue.
1912	1,761	79,717	£15,668
1913	1,901	88,143	£17,584
1914	2,021	95,803	£18,878

During the year the directors issued £850 4½ per cent. debenture stock, £5,379 6 per cent. cum. pref. shares, and £350 ordinary shares. Owing to the continuous growth of the business of the company the directors are still looking towards issuing further debenture stock, and ordinary shares. The expenditure on capital account on December 31st, 1914, amounted to £138,955. During 1914, over three miles of new distribution cables have been laid.

	1913.	1914.
Units generated	1,125,640	1,237,901
Sold	854,016	939,700
Used in works, offices, etc.	28,555	35,085
Total accounted for	882,571	974,785
Energy dissipated in transformers, etc. ...	243,069	263,116
Maximum supply demanded	645 KW.	643 KW.

The depreciation and renewals fund account now stands at £14,395, and the reserve account at £850.

Bromley (Kent) Electric Light and Power Co., Ltd.—The directors report that during 1914 the connections have increased from 3,850 to 4,089 KW., but the effect of the war, especially during the last quarter, has been to seriously reduce the current sold. The result of the year's trading, inclucing £1,805 brought forward, shows a profit of £13,884, and after payment of debenture interest and trustees' fees, &c, amounting to £3,013, there is a balance of £10,871. An interim dividend at the rate of 4 per cent. per annum was paid for the half-year in October, and the directors recommend the payment of a further dividend for the second half-year at the rate of 10 per cent. per annum, making a total dividend of 7 per cent. for the year, that £4,000 be placed to general reserve account, leaving a balance of £1,621 to be carried forward.

Telephone Co. of Egypt, Ltd.—After providing for **debenture interest, &c., the accounts for 1914 show a profit of £198,281, inclusive of £134,646 brought forward; further dividend of 6 per cent. on both the preferred and deferred shares, making the usual distribution of 10 per cent. for the year are to be paid, carrying forward £171,550.**—*Financial News.*

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets returned after Easter to their accustomed haunts, invigorated and refreshed by the change. Members of the National Guard who went to Brighton were amongst the few dissatisfied people, the weather having played them false for the greater part of the time. The signalling section, which was to have had tests in Morse reading, etc., was disappointed of its hopes; but, speaking generally, the old Stock Exchange joke was fairly applicable—that the principal features of the markets after the holiday were sunburnt—and cheerfulness dominated most sections.

There is still brisk demand for investment securities of all kinds, and the difficulty is to get sufficient stock to fill the buyers' requirements. Gilt-edged issues are being eagerly scapped up, and the prospect of another big War Loan fails to subdue the appetite of those who are content with 4½ per cent. on their money, combined with as much security as can be expected while European war rages. Jobbers in the telegraph department retort with bitterness that they are not certificate manufacturers, when they are charged with having neither enterprise nor stock. Conspicuous amongst more speculative markets is the strength of rubber shares, where the activity is such that, anomalous as it may appear, some of the firms connected with the market put in two or three days' work in their offices during the Easter holidays.

The rumour as to fusion between the County of London, the South London and the South Metropolitan companies is obtaining publicity, but it is pointed out that this probably started through the Chairman of the County of London stating

at the recent meeting that the company had acquired a block of South London shares and that a working agreement between the two concerns was not improbable. As regards the South Metropolitan Co., the report has been sufficient to maintain the price of the ordinary shares at about 12s. 6d.

City of London shares are good at 14¼, and County preference at 11¼ are ⅛ higher. The rises in the rest of the list are well maintained, and there is little floating supply of shares—still less of debenture stocks. The coming rise in the price of the current has had no effect upon quotations of electricity supply shares, so that those who expected a similar result in this department to that amongst gas securities, which fell upon the announcement of increased prices, had no cause for their apprehensions. The reason, of course, as we pointed out before, lies in the fact that whereas the gas companies are regulated by the sliding scale, those of the electricity supply undertakings are not subject to any such restriction.

We append our usual list of representative stocks and shares in the markets connected with the industry :—

	Mean price, July 27, 1914.	April 6, 1915.	Rise or fall this week.
Home Electricity Companies.			
Brompton Ordinary	9¼	8½	—
do. 7 per cent. Pref.	8⅝	7⅝	—
Charing Cross Ordinary	5¼	4¼	—
do. do. do. 4½ Pref.	4⅜	4⅜	—
do. do. City Pref.	4⅜	4	—
do. 4 Deb.	91½	90	—
Chelsea	4⅞	4⅜	—
do. 4½ Deb.	96½	92	—
City of London	16	14¼	+ ¼
do. do. 6 per cent. Pref.	13½	12⅞ xd	—
do. do. 5 Deb.	116½	113	—
do. do. 4½ Deb.	100½	98	—
County of London	12	11⅜ xd	—
do. do. 6 per cent. Pref.	12	11¼	+ ⅛
do. do. 1st Deb.	102½	100	—
do. do. 2nd Deb.	100½	97	—
Kensington Ordinary	7½	7	—
London Electric	1 7/16	1⅜	—
do. do. 6 per cent. Pref.	5 1/16	4⅝	—
do. do. 4 Deb.	99½	67	—
Metropolitan	8¼	8	—
do. 4½ per cent. Pref.	4 7/16	4	—
do. 4½ Deb.	97⅛	96	—
do. 3½ Deb.	83	80	—
St. James' and Pall Mall	9⅜	8¼	—
do. do. do. 7 per cent. Pref.	7	6⅜	—
do. do. do. 3½ Deb.	84½	80	—
South London	8 7/16	8	—
South Metropolitan Pref.	1⅜	1¼	—
Westminster Ordinary	8⅜	7½	—
do. 4½ Pref.	5⅛	4⅜	—
Telegraphs and Telephones.			
Anglo-Am. Tel. Pf.	108½	108⅜	—
do. Def.	23	21⅜	+ ⅛
Chile Telephone	7⅜	6⅜	—
Cuba Sub. Ord.	8½	8⅜	+ ¼
do. Pf.	16½	15	—
Eastern Extension	13⅜	13	+ ¼
do. 4 Deb.	97⅞	92	—
Eastern Tel. Ord.	130½	132	+1
do. 3½ Pf.	77⅛	73½	—
do. 4 Deb.	96¼	93	—
Globe Tel. and T. Ord.	11⅜	11¼	+ ¼
do. Pf.	13⅜	13	—
Gt. Northern Tel.	32½	29	—
Indo-European	59	51	—
Marconi	1 13/16	1⅞	+ ⅛
New York Tel. 4½	101	99⅛	+1¼
Oriental Telephone Ord.	2 5/16	2	—
do. Pf.	1 7/16	1 3/16	—
Tel. Egypt Deb.	98	88½	—
United R. Plate Tel.	6⅝	6	—
do. Pf.	5½	5	—
West India and Pan.	1½	1 3/16	—
Western Telegraph	13⅝	13⅜	+ ⅜
do. 4 Deb.	96½	93	—
Home Rails.			
Central London, Ord. Assented	83	77	+ ⅛
Metropolitan	37½	29	—
do. District	21⅜	17	— ½
Underground Electric Ordinary	2¼	1 13/16	—
do. "A"	7/8	5/6	—
Income	88	81	—
Foreign Trams, &c.			
Anglo-Arg. Trams, First Pf.	4⅞	4½	—
do. 2nd Pf.	4½	3¾	—
do. 4 Deb.	91	84	—
do. 4½ Deb.	98½	90	-1
do. 5 Deb.	96	88	—
Brazil Tractions	66	58½	- 1
Bombay Electric Pf.	11⅜	10⅜	—
do. 4½ Deb.	96	91	—
Mexico Trams.	70	80	—
do. 5 per cent. Bonds	84	45	—
do. 6 per cent. Bonds	76	80	—
Adelaide Sup. 6 per cent. Pf.	5½	5½	—
do. 5 Deb.	104	103	—
Manufacturing Companies.			
British Westinghouse Pref.	1⅜	2	—
do. 4 Deb.	74½	72	—
do. 6 p. lien	102½	99 xd	—
Callenders	12	12	—
do. 5 Pref.	5⅜	4⅞	—
do. 4½ Deb.	98½	98	—
Castner-Kellner	2⅜	2 3/16	—
Edison & Swan, £8 pd.	15/32	14/6	—
do. do. fully paid	1¼	2⅛	—
do. do. 4 Deb.	69	63	—
do. do. 5 % Deb.	63½	60	—
Electric Construction	15/32	13/9	—
do. do. Pf.	1/16	1	—
Gen. Elec. Pf.	10½	10	—
Henleys	15	13½	— ½
do. 4½ Pref.	5	4⅝	—
do. 4½ Deb.	100½	97	—
India-Rubber	9	9½	+ ½
Telegraph Con.	83½	87	—

Marconi shares have risen to 1⅞, a gain of 2s. 6d., so that the company's recent circular, intimating that there would be no dividend at present on the ordinary shares, has had the anomalous effect of causing the price to harden. Expectation looks for the previous dividend to be maintained when the board consider it advisable to make a distribution. American Marconis have risen to 10s., on account of the prosperity which is said to have recently visited the United States, and which is reflected in very substantial rises amongst American railroad shares of all classes, from investment to rubbish. It would appear that the unfavourable effects of the war upon the States are already wearing off, and that the country is beginning to feel the benefit of the demand from the belligerent countries for those things which the Americans are so well able to supply. Canadian Marconis are better at 5s. 6d.

In the Home Railway market, Central London Assented ordinary improved to 77, and a buyer this week had to pay 78 for stock, the preferred ordinary changing hands at the same price. Districts, however, are dull at 17. Home Railways as a group are stagnant, with a tendency to depression; and this market has received none of the attention which the public are bestowing upon other investment parts of the House. The prior-charge stocks, however, are firm, the disposition in their case being much better than that governing the Ordinary issues.

New York Telephone bonds are 1¼ up at 99¼. Anglo-American Telegraph deferred is better, and there are noticeable rises in Cuba ordinary, "China" shares, Eastern ordinary stock, and Western Telegraphs. The last-named are ⅜ up at 13⅜, with very few shares about. The manufacturing division finds it difficult to supply the demand from investors. Henley's are a shade easier at 14½; but India Rubbers gained ½, and British Insulated are good at 11⅛. British Aluminium shares have fallen back to 20s. 6d., the recent report falling short of bullish anticipations, and this price is still cum. the dividend of 1s. per share.

Mexican matters look a little less black; and although prices amongst the utility companies are no better than they were a week ago, the pressure to sell is somewhat relaxed. If we were giving tips, we would venture to suggest that the speculator might find in this department useful scope for his peculiar talents. Brazil Tractions are a point higher at 53¼, most things connected with the Republic having improved within the past few days.

Armament shares are mending again, Vickers and Armstrongs both being slightly better. The rubber market, however, is the most active section amongst industrials. While the price of rubber itself keeps steady, the attractions of the well-managed producing concerns have suddenly attained public recognition in a highly practical manner; so that those whose business lies along rubber paths find they have as much as they can do to cope with the work flung upon their shoulders. Probably the animation and excitement will prove transitory. Speculation being eliminated, people have to pay for what they buy; and, after all, there is not such a lot of money about that rubber shares can be bought for an indefinite period. So the market will no doubt fall upon quiet times again; but, meanwhile, orders are pouring in from all parts of the country. The wise man, of course, is he who sells when others are buying, though, in applying this axiom to rubber shares, it deserves to be remembered that, even at their advanced prices, the majority return handsome yields, and are likely to pay more in the near future.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

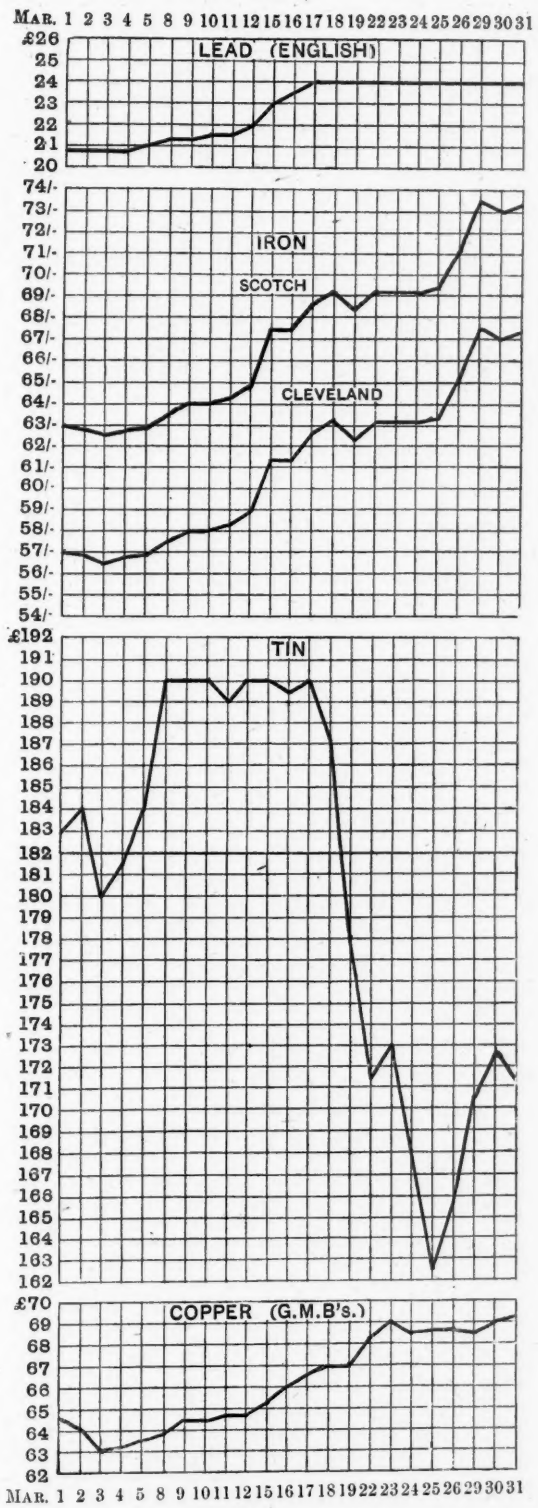
Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Bath	Mar. 10	2,503	— 422	10	6,331	— 725	..	..
Blackpool-Fleetw'd	April 3	1,825	+ 61	13	4,143	+ 118	8	..
Bristol	„ 2	34,297	+4,071	13	109,792	+11,280	30·5	..
Chatham and Dist.	Mar. 18	3,448	+ 689	11	10,541	+ 1,612	14·98	..
Cork	April 1	1,805	— 40	13	5,653	— 216	54·25	..
Dublin	Mar. 26	22,803	+ 806	12	66,945	+ 3,481	9·89	..
Hastings	„ 25	3,098	— 33	..	..	+ 73	19·8	..
Lancashire United	„ 31	6,088	— 18	13	19,550	— 214	42	..
Llandudno-Col. Bay	„ 26	890	+ 151	16	2,924	+ 489	6·5	..
Tyneside	„ 24	2,082	+ 100	12	5,965	+ 279	11	..
Anglo-Argentine	April 1	206,972	-20,418	13	610,676	—74,571	..	..
Auckland	Mar. 12	19 907	—3,425	36	183,935	+ 4 513	25 42	1·03
Calcutta	„ 27	17,044	— 819	..	..	— 3,494	..	..
Kalgoorlie, W.A.	Jan.	2,872	..	4	2,872	..	..	..
Madras	Mar. 15	3,427	— 65	10	9,081	— 203	..	..
Montevideo	Feb.	30,007	-5,798	8	118,136	—19,765	..	..
Dublin-Lucan Rly.	April 2	433	+ 53	13	1,555	+ 38	7	..

Stock Exchange Notice.—Application has been made to the Committee to allow the following securities to be quoted in the Official List :—

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Further issue of 60,179 ordinary shares of £1 each, fully paid, Nos. 737,501 to 797,679, and 224,833 5 per cent. preference shares of £1 each, fully paid, Nos. 687,501 to 912,332.

METAL MARKET.

Fluctuations in March.



London Electrical Workers: Threatened Strike.—In the *Times* of April 1st it was stated that the electrical workers employed on repair work on shipping in the Port of London had decided at a mass meeting to strike on April 14th, unless their demands were conceded. The men are mainly employed on fitting up ships taken over by the Government. They are asking for a regular hourly wage of 1s. and a 48-hour week. The same paper states that the engineers and mechanics employed on the tube railways of London have decided to cease work on April 10th unless certain wages concessions are granted by the "T.O.T." combine by that date. Several hundred men who are engaged in the repair and maintenance work of the railways are affected.

TEMPERATURE MEASUREMENT IN A MODERN POWER HOUSE.

By CHAS. S. JEFFREY, A.M.I.E.E., A.Amer.I.E.E.

It should be the aim of every engineer, in order to secure maximum efficiency, to run his plant as nearly as possible under test conditions; in other words, he should make accurate measurements at short intervals of all the factors affecting its efficiency. Of these factors, the measurement of temperature receives least attention in most power houses, although having regard both to economy and to the safety of the plant it is of very great importance.

Various modern types of temperature-measuring instruments were described by Mr. Robert S. Whipple in the *Proceedings* of the Institution of Mechanical Engineers, No. 3, July, 1913. The types of instruments best adapted for power-house work are the mercurial glass thermometer, the indicating or recording mercurial thermometers of the Bourdon gauge pattern, and the electrical resistance thermometer.

Excluding the temperature of the furnace, the highest temperatures that have to be measured are those of the boiler flues and of the live steam, which seldom exceed 650° F.; and the lowest, that of the atmosphere.

In a complete electrical installation the following points should be fitted with thermometer elements and connected up to the temperature switchboard :—

1. Boiler feed-water storage tank.
2. Boiler feed-water inlet and outlet of economiser.
3. Exit flue gases inlet and outlet of economiser.
4. Boiler steam header.
5. Main stop valve of prime mover.
6. Generator stator.
7. Generator inlet and outlet of ventilating duct.
8. Generator bearing oil pipes.
9. Exhaust steam to condenser.
10. Condenser cooling-water suction and discharge.
11. Hot well.
12. Coal bunkers.

Boiler Furnace Temperature.—In the foregoing list the temperatures of the boiler furnaces have been omitted because the temperature-measuring instruments suitable for the other sections of the plant in a power house cannot be used for this purpose. The most suitable instrument for measuring furnace temperature is the optical, or radiation, pyrometer, but such instruments can hardly be entrusted to a fireman or a meter reader.

A knowledge of the temperature of the furnace in a steam boiler may, however, be of great value.

It is now generally recognised that the efficiency of combustion in a boiler furnace varies with the size and composition of the fuel, and that, for example, a furnace which may be well suited for burning anthracite is uneconomical when fired with bituminous coal. In burning anthracite combustion takes place almost entirely on the fire-bars, owing to the very high percentage of fixed carbon, but with bituminous coal much of the heat is obtained from the combustion of the volatile gases after they have been distilled from the coal. High temperature is necessary for the complete combustion of these gases, and for this reason it is necessary to use some form of reverberatory furnace to prevent them coming prematurely in contact with the boiler tubes and being cooled below the temperature necessary for complete combustion.

Although pyrometers for indicating furnace temperature are unnecessary under ordinary working conditions in a power house, they might well be more frequently used in boiler testing, as an assistance to the engineer in determining which is the best size and quality of fuel to use in a particular style of furnace, or, conversely, the best form of furnace for the combustion of a particular class of fuel. The degree of combustion that has been attained is given by analysis of the flue gases. The use of pyrometers in the furnace is suggested to locate the cause of imperfect combustion as shown by the flue-gas analysis.

If high-temperature pyrometers were more commonly used, improvements in the design of boiler furnaces would

assuredly result. Station engineers, more particularly those domiciled abroad, are often faced with the problem of adapting their furnaces for the combustion of fuel of an entirely different quality from that for which they were originally designed.

A simple method of estimating approximately the temperature of a boiler furnace is by the analysis of the flames by means of violet glass. The greater the intensity of the action in the boiler furnace the greater will be the actinism of the rays emanating from it; or, in other words, the more perfect the combustion the greater will be the proportion of violet rays emitted by the flames. By means of the violet glass all the rays less active than violet are cut off. In a well-designed furnace, working under good conditions, the whole of the internal surface will be incandescent, and will appear luminous when viewed through the violet glass. If the temperature of the gases is low, then dark patches will appear where the rays are less active than violet, indicating that at those parts of the furnace complete combustion of the volatile gases may not take place.

Boiler Flue Gases and Economiser Temperatures.—Measurement of the temperature of the exit gases from the boiler flues is a matter of no difficulty, and can be effected by means of electrical distance thermometers or by mercurial thermometers of the Bourdon type. Mercurial pyrometers are accurate and reliable, but, if readings are to be taken frequently, it is necessary to have one in the flue of each working boiler, because the time taken for the pointer to reach the true temperature reading is considerable. Flue-gas pyrometers of the Bourdon pattern are more expensive instruments, and are more liable to derangement, than the resistance element of the electrical thermometer. It is true that the indicating instrument of the latter is much too delicate to be installed in a dirty boiler-house in the open, but proximity to the test points is not of great importance. With electrical thermometers it may be considered necessary in a large station to have more than one switchboard, but, in the opinion of the writer, the advantage lies rather in being able to take all the readings at one point.

Usually it is not advisable to admit the feed water to the economiser at a temperature of less than 100° F. on account of the condensation of the corrosive gases from the flues which takes place against the cold tubes of the economiser. Very rapid deterioration of the economiser may take place from this cause. If no exhaust steam is available for the preliminary heating of the feed water up to about 100° F., some engineers feel justified on this account alone in using a live-steam heater. Where feed heaters and economisers are used, temperature readings are the only means available of determining the efficiency of their operation. If these readings are taken regularly, any falling-off in the performance of the economiser or feed-water heater through dirty or scaled tubes can be detected. All economisers should be fitted with thermometers at the inlet and outlet of the flue gases and at the inlet and outlet of the boiler feed water.

Where means are available for determining the evaporation of each boiler, the temperature of the flue gases gives an indication of the condition of the fire-brick baffles. Low evaporation with high flue temperature will indicate that the gases are leaking past the baffles without giving up their heat to the boiler.

When the boilers are known to be in good order, the shift engineers can readily tell by means of the flue temperature readings whether the furnaces are being fired so that each boiler bears its proper share of the load.

Steam Temperature.—When the steam is not superheated a thermometer is not necessary in the boiler header, as the temperature of the steam has a fixed value corresponding to every value of the pressure. Accurate pressure gauges are required by law, and from them the temperature can be deduced. The use of superheated steam in electrical generating stations is now almost universal, however, as the efficiency of the steam turbine increases with increase of superheat. From the standpoint of efficiency it is quite as important accurately to maintain the steam temperature as it is to maintain the steam pressure, yet in most stations a recording pressure gauge is considered a necessity, while the steam temperature readings are taken most casually. The efficiency of a boiler is the ratio of the heat units imparted to the steam to the heat units taken from the fuel. Unless a means of measuring the temperature of the steam is available the efficiency of the boiler cannot be determined.

Generator Windings.—Temperature readings of great importance, more particularly with reference to the safety of the plant, are those of the windings and cores of generators and transformers. It is impracticable to take temperature readings of the rotor of a loaded generator, but those of the stator can always be determined. It is fortunate that in turbo-alternators the rotor is seldom subjected to a pressure exceeding 100 volts, and carries a current fluctuating within comparatively narrow limits, so that the danger of an excessive rise in temperature is negligible, if the ventilating arrangements are in order. Some interesting comparisons of different methods of measuring stator temperatures were given in a paper presented under the auspices of the Standards Committee of the American Institute of Electrical Engineers, and were recorded in the *Proceedings* of that Institute for February, 1913. The method recommended is the insertion of exploring coils in the hottest part of the machine. The authors found that the temperature rise at the hottest part might be as much as 60 per cent. greater than was indicated by mercurial thermometers placed against the core or in the ventilating slots. If suitable provision is made in designing the generator, an exploring coil in the form of a distance thermometer element can be placed in any part of the core. Without this provision the electrical thermometer will still give higher readings than can be obtained by mercurial thermometers, because it is not subject to the restriction that it must be placed where it is easily accessible. The mortality caused among mercurial chemical thermometers by poking them into ventilating slots is very high, and if they are left in the machine after it is shut down they will inevitably be broken by the cleaners.

In a modern turbine it is of great importance that an adequate supply of air for ventilating the generator should be maintained. Should a thermometer not be provided in the core of the machine itself, the temperature of the inlet and outlet air should be taken. Although this does not give the true temperature of the machine, an increase in the difference of temperature between the inlet and outlet air will indicate that the temperature of the generator has increased, or that the supply of air has been interrupted. It is the temperature rise that limits the load capacity of the machine, and manufacturers' rating of load capacity may be largely discounted by the conditions under which it is operated. For example, in some parts of India there is a difference of 50° between the minimum and maximum shade temperatures.* It is obvious that a machine can be run at an overload for a much longer time when the atmospheric temperature is 40° than when it is 90°.

The writer has been struck by the diversity of opinion among the shift engineers of his acquaintance as to when a machine is sufficiently loaded; and he would suggest that after the maximum permissible temperature has been carefully determined, shift engineers should be guided by the thermometer as much as by the ammeter. The thermometer gives a steady reading, whereas the ammeter, particularly on traction generators, often varies so much as to make it a matter of some difficulty to determine what the load actually is. It is desirable that the thermometers should be placed in the centre of the air trunk, where the wind velocity is highest. The ventilating trunks are very often difficult of access, and to take the readings with mercurial thermometers it is often necessary that the attendant should go into them bodily. The advantage of distance thermometers in this section of the plant is obvious.

Bearings and Oil Supply.—In a steam turbine the temperature of the oil gives an indication of the temperature

* The use of wet air filters reduces the temperature variation of the air available for cooling very much, because with this type of filter the air is delivered to the machine at the temperature indicated by the wet-bulb thermometer. The variation of the dry-bulb thermometer is always much greater than that of the wet-bulb thermometer. The wet-bulb reading seldom exceeds 80° F. in any part of the world, while the dry-bulb reading may reach 120° F., or even higher. 80° F. is a very high wet-bulb reading, and only in very humid tropical districts is that figure approached

of the bearings, provided, of course, that the rate of flow of the oil is clearly visible. However reliable distance thermometers may be, it is not suggested that they can displace or reduce appreciably the amount of attendance that is required on an important piece of plant like a steam turbine, and it would be unwise to put distance thermometers where close personal attention is required, but where very accurate determination of the temperature is not necessary. f the bearings are not readily accessible, as in a vertical steam turbine, then separate resistance elements might be placed in each of them, but ordinarily, in the opinion of the writer, it is sufficient to know the temperature of the suction and discharge pipes to the oil tanks. The oil suction temperature reading enables the supply of cooling water to the coils in the tanks to be controlled so as to maintain the desired temperature of the oil supplied to the bearings.

Condensers.—Temperature readings at the condensers are economically of great value, particularly when the cooling water is discharged to cooling towers. For every value of the vacuum, saturated steam has a corresponding temperature, and the injection water and condensate discharge should as nearly as possible approach the steam temperature. It is the function of the condenser to take only the latent heat from the steam, and if the condensate or injection water discharge temperature is below the temperature corresponding to the vacuum (or more correctly the absolute pressure), it means that unnecessary work is being done in the condenser. With jet condensers it is practicable to keep the water discharge within 3° or 4° F., and with surface condensers within 8° F., of the temperature of the exhaust steam. The advantages of maintaining high-water temperatures are :—(1) Less water is circulated through the condenser and the power consumpt of the circulating pumps is thereby reduced ; (2) if the condensate is used for boiler feed water there is an obvious economy of fuel in keeping the temperature high ; (3) if the water is discharged to cooling towers the latent heat of the steam taken up by the injection water is much more readily dissipated when it enters the tower at a high temperature.

Four thermometers should be fitted to each surface condenser, namely, in the exhaust steam pipe, the condensate discharge, the injection water suction, and the injection water discharge. In a jet condenser, of course, the condensate discharge thermometer is not required, as the condensate is carried off with the injection discharge water.

In the opinion of the writer, the advantages of the electrical distance thermometers in this connection are very marked. The time that is required to take condenser temperatures with mercurial thermometers is too great to permit of their being taken very frequently, and as the conditions in the condenser change with every variation of load it is essential that they should be taken frequently.

Coal Bunkers.—With certain classes of bituminous coal there is considerable danger of spontaneous combustion, particularly if the coal has been stored when wet. Coal in a finely-divided state, such as slack or dross, is more liable to ignite spontaneously than large coal. It is possible for combustion to go on for a long time with very little emission of smoke, and often it is not observed until the fire has a good hold. A case is on record in an Indian colliery where the first indication that a large stack was on fire was the total disappearance of two coolies who attempted to cross over it. The weight of the men broke through the upper crust of the stack and plunged them into a burning crater, in which no trace of them was ever found. The danger of spontaneous combustion is well known to marine engineers, and the law demands that the temperature of a steamship's bunkers must be recorded in the daily log.

Various methods have been suggested for preventing spontaneous combustion ; and some diversity of opinion exists as to the efficiency of the common practice of ventilating the interior of the coal stacks. Storage in an atmosphere which does not support combustion, carbon dioxide, for example, has been suggested, but there are few electricity supply stations where the danger is sufficiently great to justify the expenditure which would be necessary with such an arrangement. In most cases it will be sufficient if means are available for locating and extinguishing an outbreak as soon as it occurs.

A crude form of thermometer which is sometimes used for this purpose is simply an iron rod thrust into the centre of the stack. Any increase of temperature in the body of the coal will be readily conducted along the rod and become apparent to the touch. The method commonly used on board ship is to have an iron pipe built into the bunker and opening on to the deck, down which a maximum thermometer can be lowered and the temperature at the centre of the coal registered. This method can be used in a supply station, although the bunkers are usually more inaccessible than on board ship. A valuable application of the electrical distance thermometer is to indicate the presence of spontaneous combustion. Readings can be taken with far greater frequency than is possible with any other form of thermometer, and the elements, completely enclosed in an iron pipe, can be placed without risk of damage in the most inaccessible part of the coal heap or bunker.

In the opinion of the writer, to make it practicable to take frequent readings in a large power house, it is necessary to install a system of electrical distance thermometers, particularly if it is situated in a country where subordinate employés who have a sense of responsibility are difficult to find. Many of the points at which observations must be made are of necessity awkwardly situated, and if the observer is required to visit each in turn it requires some strength of character to debar him from supplying many of the readings from his imagination.

A 30-point distance thermometer can be installed for approximately £150, or including depreciation and maintenance, an annual charge of about £20. For a similar installation using ordinary glass thermometers, with careless handling the annual bill for renewals may approach or even surpass this figure. The advantage of the electrical thermometer is more apparent on a large installation, however, and for fewer than 10 points might hardly justify the expenditure under ordinary circumstances.

In a power-house electrical thermometer installation it is desirable that the switchgear should be mechanically strong, and that the switch contacts should be large. Variations in the resistance of the circuits from other causes than variations of temperature at the thermometer elements are fatal to accuracy, therefore the necessity for good connections cannot be over-emphasised.

The writer has experienced a good deal of trouble with a well-known make of distance thermometer on account of the lightness of the switchgear. The design gives a wonderfully neat appearance, and, provided the contacts are all tight, is perfectly satisfactory in operation. However, with careless handling, the instrument and switches are easily deranged, and they are so delicately constructed that considerable skill is required for their readjustment.

REVIEWS.

Boilers, Economisers and Superheaters ; their Heating Power and Efficiency. By Robert H. Smith. London : Crosby Lockwood & Co. Price 7s. 6d. net.

This book, like the earlier works of its author, fills us with mixed feelings, in this instance we are glad to say somewhat different from those of previous occasions.

We marvel at the author's indefatigable industry, at his mathematical genius and his determined application of mathematics to problems of engineering which, we think, have never been really suitable for such treatment.

But to begin with, is not the author wrong in supposing that steam engineering writers have not perceived, or have neglected, the fact that the radiation from the hot fuel on the grate is far more effective than any other part of the boiler ? A Lancashire boiler gives, say, an evaporation of 6 lb. of water per sq. ft. of surface per hour, but it is always understood that the work over the fire grate is several times this average, and in water-tube boilers has not radiation from the fire always been credited with the bulk of the abnormal evaporation of the first bundle of tubes ?

The author, indeed, admits this ; his quarrel is with text-books, presumably with those rules which are based on the mean effect of heating surface. If we remember rightly, many years ago such rules did estimate fire-box surface separately from tube surface or other surface.

This book aims to correct the omission by reducing the complex laws of heat transmission to diagram form ; such diagrams, if enough are asked for, will be supplied in full size, their photographed reproductions being too small for drawing office use. In reading the author's remarks we exclaim : "Is Saul also among the prophets?" for the author has endeavoured to treat of an engineering subject on what he calls simple lines, avoiding pedantic exactitude never justified by the degree of closeness with which the data of boiler practice are known. We feel that this distinct break from the author's former methods will greatly enhance the value of his present work, and as a sample let us cite what he says on the calculation of calorific capacity of coals.

The author takes the percentage of carbon in coal as actually fired on the grate, be it dry or wet, that is to say, not the percentage of carbon as obtained in the laboratory for really dry coal, but the percentage of carbon in the more or less watered coal actually fired. Then he multiplies this percentage by 17,200, and the product is the calorific capacity of that pound of coal, including its hydrogen effect and its water effect. Taking five British coals, for the rule is only given for British coals, viz , Welsh, Newcastle, Lancashire, Derbyshire and Scotch, the following figures are found :—

	Welsh.	*N'C.*	*Lanc.*	*Derby.*	*Scotch.*
Calculated heat of combustion ...	14,070	13,840	13,030	13,020	13,120
Per cent. of C. × 17,200	14,120	13,710	13,000	13,290	12,970
Diff.	+ 50	− 130	− 30	+ 270	− 150

The results are certainly creditably close.

But whose figures are 4,320 and 14,400 for the calorific capacity of carbon burned to its two familiar oxides? Berthelot's figures are 4,415 and 14,647, while Thomsen gives or accepts 4,350 and 14,544, which are the figures of Fabre and Silbermann. It is a pity that engineers cannot agree on the calorific capacity of both carbon and hydrogen. Why not accept Berthelot's values until there appears good reason to revise them ?

Anyhow, the author's very simple formula will be welcome if we can rely upon the calculated heat of combustion as found from the constituents of the coal being really comparable with possible results.

For oil fuel the author deduces a formula 22,200 × % C., and for samples of various oils prints the following comparisons :—

	Amer.	*Russia.*	*Burma.*	*Borneo.*	*Texas.*
Actual bomb values	19,600	19,400	18,800	18,800	19,200
% C. × 22,200 ...	18,800	19,200	19,200	19,500	19,000
Difference ...	− 800	− 200	+ 400	+ 700	− 200

The weight of gaseous products per pound of fuel is 13·45 c + 1 where c is the percentage of carbon. This is the actual chemical requirement.

If the air used is n times the chemical amount the equation become 13·45 c n + 1, omitting any steam from fuel wetness or from steam blowers. And so the value of n is found to be $n = 27{\cdot}3 \times$ % of $CO_2 - 0\,1$, and is to be used when the percentage of CO_2 has been found by, say, an automatic recorder.

The author next takes up the question of the specific heat of the flue gases, or the value of h = heat given up by a fall of 1° of temperature. He finds $h = 0{\cdot}3 + 3{\cdot}2$ C n for both British and metric measures. The subject is further developed, and the author applies his formula to the same five British coals. The various other problems of a boiler are similarly treated.

We note that in his studies for this book the author has met with efficiencies greater than unity, in no fewer than our official tests ; in one case as much as 15 per cent.

This book is extremely interesting ; the best we have seen from the author's pen, and one which gives one much to think about. But we wish the author would eliminate firstly and nextly from his vocabulary. Neither word is English, and the author in the past has employed a sufficient stock of long words without adding syllables that do not belong to these English monosyllables.

Drawing for Electrical Engineers. By G. W. Worrall. London : G. Routledge & Sons, Ltd. Price 2s. net.

A book of this type describing the mechanical construction of electrical machines has long been sadly needed. In many electrical designs produced to-day lack of knowledge of mechanical details on the part of the designer is apparent. Methods of electrical design are now more or less standardised and uniform ; it is the mechanical construction which distinguishes the products of one manufacturer from those of another. It is, therefore, surprising how little attention has been paid in text-books to the subject of mechanical design. An average second or third-year student in a technical college may be fairly well acquainted with electrical design as well as with engineering theory, but ask him to design a motor end bracket with details of bearing and shaft journal—the result is generally distressing.

Electrical text-books have given the subject most superficial and often worthless treatment. Those professing to deal with mechanical construction have been treatises on engineering theory, throwing very little light on modern methods of construction.

The advent of this book setting forth features of modern construction will, therefore, probably be very welcome, both to technical students and to draughtsmen and engineers. The author admittedly does not attempt to deal with the general principles of engineering construction and drawing, but only to impart to the "young electrical engineer" an "elementary knowledge of the construction and proportions of the chief types of electrical machinery." He should at least succeed in doing this, and probably not a few "old" electrical engineers will glean some of this elementary knowledge.

The book is essentially a collection of some 70 working drawings, most of them fairly recent, by the leading manufacturers in this country, with a simple description of the principles involved in each. Bearings, shafts, A.C. and D.C. rotors and stators, and collector and brush gear, constitute the list of subjects discussed. It is rather a pity that the important subject of windings is conspicuous by its absence. One or two of the drawings shown are somewhat out of date, and the original sketches at the beginning of the book are hardly representative of modern practice. There is a contrast, too, between the detailed description of brush gear and the scanty treatment in the last chapter of slip rings. The book would probably have been of greater value had the drawings been reproduced to a much larger scale.

On the whole, however, the drawings are good and well described, and the book is well worth its low price.

Principles of Electrical Measurements. By Arthur W. Smith. London : Hill Publishing Co. Price 8s. 4d. net.

Strictly speaking, this is a laboratory text-book, and it bears the marks of careful preparation by one who has met and appreciated the many difficulties encountered by students in the early stages of experimental electrical engineering. It is similar in many respects to the books produced for similar purposes and under like conditions on this side of the Atlantic ; it is certainly no better and, perhaps, no worse than the usual type of text-book in common use in the electrical laboratories of our English Technical Colleges and Universities. But it has some important features that are well worth consideration, and even emulation, in this country.

An introductory chapter deals with units and definitions, and incidentally startles us with the following unusual definition :—"Unit resistance is that resistance in which one erg of heat is produced each second by the passage of unit current." Although unusual, this definition is, of course, exactly equivalent to the one commonly derived from the statement that "one erg of work is done when unit electromagnetic quantity of electricity falls through unit of potential difference." The specifications of the international ohm, ampere and volt are also included in this chapter, together with notes on the use of Weston cells, current balances and standard coils for standardisation purposes.

The author does well by beginning with the use of ammeters and voltmeters in the measurement of current, E.M.F., resistance and power. He also does well to use a paragraph to explain the application of Ohm's law to the simple circuit, and the difference between available E.M.F. and the potential difference over the whole circuit. Dr. Smith is also a humorist, for he follows up a neat and sound treatment of the subject of useful power from a cell by this problem :—"How much power is expended in an ammeter of 0·01 ohm resistance if it is connected to a storage battery of 10 volts and 0·01 ohm internal resistance? Why is it best not to try this actual experiment in the laboratory?"

The second subject treated is ballistic galvanometer and condenser methods, and all the usual experiments on E.M.F.'s and capacities are fully dealt with here and in Chapter IX. The current galvanometer is considered in the third chapter, and this naturally leads up to Wheatstone's bridge and potentiometer methods, to both of which subjects admirable chapters are devoted. The calibration and use of the simple slide-wire bridge are first described, then the "decade" bridge box (which is the American form of our Post Office box), and its use in the location of faults, and finally the Kohlrausch bridge for resistance of electrolytes and Carey-Foster's bridge for comparison of nearly equal resistances. The lack of any reference to the P.O. box is, of course, a regrettable feature from an English standpoint.

Chapter VI, on the Measurement of Current, gives some account of hot-wire, moving-coil and electrolytic methods, as well as of the Kelvin balance and electrodynamometer, while Chapter VIII deals with the application of the latter instrument to the measurement of power.

Considerable space is devoted to magnetic measurements, and a whole chapter to the theoretical considerations of the magnetic circuit. The various standard methods for obtaining B-H curves and hysteresis loops by Hopkinson's bar and yoke, double bar and yoke and step-by-step methods are described, but a curious omission is made in that there is no reference to the magnetometric method.

There are two chapters on Self and Mutual Induction, and the multitudinous methods of measuring them, and then a final chapter, mainly of a theoretical description, on alternating currents.

An interesting point is that the author uses the calculus quite freely throughout the book. He also misuses the word "data" throughout the book, but otherwise there are very few errors either fundamental or incidental. As we have said, this book is not unique in any respect, but it can, perhaps, claim some merits, and perhaps a few defects that are not possessed by similar books already in use in this country.

COMMISSIONS.

[COMMUNICATED.]

This does not treat of matters military; it is a brief discussion of the *pros* and *cons* of a commercial custom which has prevailed, with variations, practically ever since England boasted a commercial system.

In encyclopædic language, we are told that a commission is a pecuniary consideration, given by a principal to an agent, or to an employé, in respect of business secured by the said agent or employé, for and on behalf of the said principal. Assuming that such business proves unprofitable to the principal and the agent or employé in no way compromises or jeopardises the negotiations, the commission cannot be withheld. This form of remuneration is founded upon an express or implied contract between the parties concerned, and such a contract may be implied from trade custom or usage.

Leaving the encyclopædic for the commercial aspect, we find that, not only in the engineering world, but in almost all fields of commercial activity, the commission problem is one of more than ordinary interest; it is, furthermore, one in which it is essential to have at the outset a clear and amicable understanding between the parties most intimately concerned, for it is easy to conceive that friction is likely to be caused by any misunderstanding arising in the absence of a definite agreement.

It is possible that this fear of petty friction is to an extent responsible for a certain chariness exhibited by some employers in regard to the wisdom of embarking upon a commission system with their salesmen.

It is sometimes argued that if one salesman is paid a fair salary without commission, and another is working partially or wholly upon commission, the individual results of the two men, other things being equal, will be approximately similar. This may be very plausible in theory, but it does not take into consideration that very natural faculty—the human element. I do not maintain that the practice is at all common, but surely there are occasions when the non-commission man has an "easy" after a good spell of business; so, of course, will the commission man upon occasion, but there is an incentive here which tends to make such a relaxation of effort more infrequent.

Again, the commission system does not appear to be so prevalent in this, our engineering industry, as in others. Why this should be so is a little difficult to imagine, but in part it may be due to the more complex and varied nature of the "lines" the engineer salesman has to sell, in contradistinction to the relatively confined scope of the commercial traveller selling tea, &c. And for this reason, that, whereas the commercial in the grocery or "soft goods" business is very frequently in the happy position of having a large proportion of his turnover provided by a more or less standardised clientèle, this rarely holds, and even then to a far less proportion, in the case of the engineer. Moreover, in any given town, the former can visit many times as many grocers and drapers, as the engineering establishments that the latter can visit, while the former has also the decided advantage of being engaged in a business where it is an old-established trade custom for orders to be given to the traveller upon the occasion of his periodical visit.

Per contra, the engineer salesman is very seldom so fortunately situated; if engaged solely upon the smaller specialities of the industry, such as lamps, in which there is a certain element of "bread-and-butter" trade, he may do so, but more often the aim of the true engineer salesman is to perform some spade-work in the discussion of alternative propositions, or sometimes, it may be said, his labours are of an educational and missionary character.

But, given the essential features of a sound working system, one which will overcome the difficulties indicated, there is no doubt that the commission system possesses advantages not to be lightly ignored. A cynic once said that "an open mind is but a polite definition of ignorance"; without going as far as this, I think it is frequently true that an open mind signifies indifference. On this subject of commissions, however, any man in a commercial position, even if connected with an establishment where commissions are not in vogue, is bound to discard, sooner or later, whatever feelings of indifference he may have had, and is forced to come off the fence, on one side or the other. This necessarily means that he examines the situation with a view to seeing how the commission system affects the first person singular.

A man in employment may be paid :—

(*a*) A fixed salary.

(*b*) A fixed salary plus commission.

(*c*) Commission only.

Some brief comments on these, and certain of the attendant pitfalls to be avoided, may be of interest.

The first (*a*) needs little further comment here other than that which has already been made, but must not be

dismissed without mention of the consolation of the assured salary to a traveller who is prevented from obtaining business through external causes entirely beyond his control, and in no way reflecting upon his salesmanship and ability. Such external causes will readily occur to everyone.

In regard to (*b*) and (*c*), commissions are almost invariably paid as a percentage in one or two forms, viz., on *turnover* or on *profits*, whilst further considerations are whether a certain initial volume of business be exempt from carrying commission, and how travelling and similar out-of-pocket expenses are to be borne. Settlement of these questions must be left to individual judgment in each case, and it should not be difficult to evolve an equitable solution.

If the commission is paid upon profits, the first question which arises is: "What are profits?" Profits may for this purpose be variously termed profits upon factory cost, with, or without, establishment charges; or they may be said to exist in the abstract, but not in the concrete, as in the case where normal profits are shown, upon the balance-sheet, but dividends are conspicuous by their absence. A more satisfactory method is to ignore profits. To some this may seem suspiciously like heresy, but the suggestion is to adjust the commission scheme upon some other basis than any which employs the elastic term "profits." This may be done by fixing a fair market price for a product, and giving the salesman discretionary powers to reduce the price within whatever limits may be arranged, but inserting a proviso that such reduced quotation bears no commission; here, again, it will be obvious that much hinges upon the "fair market price," and that, once more, is essentially a matter for amicable agreement.

Mention is made above (see Par. 2) of an employé possibly jeopardising negotiations, a possibility which indicates the necessity for a safeguard against some such condition of affairs as is suggested by the following:—Through bad engineering upon the part of one of the technical salesmen, a manufacturing establishment may find later that it is put to some considerable additional expense to complete a job in a sound and workmanlike manner, or less tangibly, for "reputation's" sake, a position which may be peculiarly exasperating, and even intolerable, if a commission to the erring salesman is also involved.

Proceeding to other aspects worthy of discussion, a common practice is to parcel out the country amongst various agents or salesmen, which is likely to cause dissension, unless the difficulties are foreseen and provided against. In the first place, it may be suggested that a salesman should reap the benefit of any and every order received from clients in his district; as it stands, this may be too one-sided, for it is readily conceivable that many orders may be received which are the result of some purely external forces, such as a trade journal reference, or a recommendation from another source. Should the salesman benefit? This is one of the most difficult problems of all, but a reasonable suggestion is that the salesman should be entitled to benefit or otherwise, according to the condition of his report book, which should contain a constantly up-to-date record of visits made, concisely tabulated and indexed.

The last problem suggests another, one very similar and possibly more difficult of solution. This is the case of a subsidiary establishment in the provinces, doing its own preliminary buying, but, for internal reasons, placing the final instructions through its head office in London. At first glance, it will be remarked that the provincial salesman should benefit, and this seems to be reasonable, assuming that the London salesman is never called upon to spend any of *his* time on the job. But if, perchance, the London representative were obliged to render assistance, a Solomon could not always administer justice.

In conclusion, the writer would say that the foregoing remarks are in no way intended to comprise a survey of the whole of the points involved, from either aspect. Such a survey would be impossible in the space available, but if interest is aroused, he feels sure that an investigation, no matter what the result, will prove of more than ordinary interest and value, and, finally, repeats his opinion that, if only for the above-mentioned "human element," the commission system has much to commend it, notwithstanding the difficulties and problems with which it bristles.

ELECTRIC COOKING.

Mr. W. R. Cooper's paper on "Electric Cooking," was discussed by the Birmingham Local Section of the Institution of Electrical Engineers, on March 17th. An abstract of the paper appeared in our issue of March 19th.

Mr. F. S. Grogan maintained that the figures published were those of a special case, and were not at all representative of the general results obtained. As to hot water, he admitted that for large quantities it was much cheaper to install a coke boiler, and only in a few special cases would it be advisable to put in an electric boiler. If an electric boiler was installed for convenience, then a 6 to 10-kw. boiler should be used, with thermostatic control attached to the hot storage tank. As to the annual consumption for cooking, 3,500 should be the average result as against the author's case of 5,000 odd units. He could quote an actual case of eight in a family where they consumed 65 units per week against 110 quoted by the author. This showed that the author could not deduce general results from his special case. The outlay of £23 15s. 6d. was very high, and included 30s. for nickel plating, 70s. for switchboard, 35s. for connections, and 10s. 6d. for thermometer. Although the switchboard was included, the author paid £9 odd extra for wiring; this was a ridiculous price. The outfit was further inflated with £10 6s. 4d. for a coke boiler, which must have included £4 over list price to cover piping and erection. Why add this to the already much too high figure for the electric cooking stove when it must be granted that an infinitely better supply of hot water had been obtained than ever before from a coal fire? This boiler with its increased economy would pay for itself in a very few months' use. Over 30 authorities and companies were already hiring out cookers to their consumers; this had encouraged the class of consumer who appreciated the benefits of electric cooking, viz., that class where the lady herself either cooked or closely superintended the cooking. The author admitted a saving of 10 per cent. for electric cooking of meat against coal cooking, but he did not state whether the original weight included the weight of bone, which for this joint represented 20 per cent. of the whole weight. If the weight of the bone was not included, the percentage figures under the "loss" column were all too high for comparison with other public results. Also had he followed instructions instead of cooking at between 250° F. and 300° F., he would have had a less percentage loss in the electric oven. Let him consult an elementary cooking book, and he would find that after sealing the meat at a temperature of 250° F. or over for a short period, meat should be cooked at about 200° F. to get the best results. The proper place for a thermometer was in the test room, and instructions should be given to control the heat based upon the manufacturers' tests. Central-station engineers took care to see that cookers were earthed. His experience with various tariffs showed that the fixed charge plus low running costs was most useful to encourage cooking loads, but let the low running charge be high enough to allow a part of the revenue to be set aside to meet deficits in the charges for hiring apparatus. The latter charge must be a low one to meet competition.

Mr. T. Smith said that if the paper had not been a mischievous one he would have considered it somewhat amusing. The author had taken a very unfair, he might say artificial, case, and it looked almost as if he allowed himself to be misled into believing that the results he had obtained were representative of the results obtained with electric cooking generally. He purchased a £23 outfit, when apparently the joints to be cooked were only about 5 lb. in weight. He must have been aware that he could purchase several outfits which would have met his requirements for less than half this amount—*e.g.*, the Carron and the Jackson. Also utensils to the value of £2 0s. were given; an absurd figure even for good aluminium utensils. The information given as to the loss of weight of meat in the process of cooking was certainly in favour of the electric cooker, although the author wished them to believe that it was not worth considering. The surprising part was, with such small joints and the heavy consumption of energy, that any saving at all was shown. The tests had been taken with ribs of beef only; if mutton, veal and pork had been included the results would have shown more in favour of electric cooking. A good cook could easily make the loss 10 per cent. on all-round cooking. The question of plugs was an important one, but the trouble would be overcome when a reliable interlocked switch and and plug was brought out. The design shown would aggravate the trouble which it was supposed to remedy. For flexible cords, no doubt the "cab tire" type was the best at present on the market. He considered that the rateable value method, with its necessary modification in special circumstances, was the best tariff that could be offered at the present stage of our development. That it was not equitable was true; no system of charging for any commodity was. The author referred to the impossible load factor of over 100 per cent.; in practice it was possible for a consumer to have a load factor which was better than 100 per cent. from the generating station point of view. He considered the author had ignored the good points of electric cooking, but had pointed out and exaggerated all its defects. Not being satisfied with the defects which became apparent to the consumer, he had gone into technical details, even outside the scope of cooking, to find defects. In his experience nothing more damning to electric cooking than this paper had been put forward, and he could confidently expect to be put up against quotation from it for some years to come.

Mr. E. P. Hollis said he thought that every oven should be provided with some form of temperature indicator, preferably, a cheap pyrometer. Domestic cooking and "wholesale" cooking, by which he meant cooking in restaurants, hotels and so forth, were

in totally different categories. At an hotel on the South Coast the hotel manager said that he paid for the whole of his electricity used in cooking by the extra money he received for his dripping. Bakers' ovens were affected by a number of factors which did not enter with the domestic oven. A large firm in Oxford Street, wishing to increase their output, found this impossible with the ordinary oven; they were pursuaded to replace the old ovens by electric ovens, with the result that four times the output could be obtained from the same space. Previously, owing to the fact that certain forms of pastry, which were cooked after bread had been baked and removed, required particular temperatures for their cooking, the firm were not always able to decide exactly which pastry should be made until a short time previous to the taking of the bread out of the oven. With the electric oven and its easily controllable temperature all such difficulties were removed.

Mr. J. H. C. Brooking said that information received by him from central-station engineers all over the country showed that the flexible cables appeared to be the weakest point in connection with portable heating appliances. The well-known C.T.S. type was well ahead of the other types mentioned as a protection against the three chief troubles of kinking, abrasion and corrodibility.

Mr. G. S. Cattell said that from the paper it would appear that the author used a cooker to cook for nine people, which was probably capable of cooking for a larger number, possibly 15. On this account the consumption per person per day came out much higher than had been found to be the average amount required. It would surely be possible to provide a complete equipment to do all the work required at a cost under half the amount shown. Switches for the heating elements were much better if double pole, and this particularly applied to griller switches if the heating element was exposed. A thermometer might give some indication of the time when the oven was hot enough to commence cooking, but failed entirely if it was desired to assist the operator when requiring to change the temperature of the oven. An intelligent cook would rapidly become sufficiently well acquainted with what the oven would do, so that a thermometer in any case was not of lasting value. The question of earthing was one which could not receive too much attention, and in this direction he would endorse all of the author's remarks. So far as the general design of cookers was concerned, manufacturers at present were working under a great disadvantage, inasmuch as the opinions of the engineers, who were the principal purchasers, differed widely. If domestic cookers could be reduced to fewer types as a result of agreement between engineers as to what was best, not only would they arrive at something more nearly approaching the ideal, they would also be able to manufacture under such conditions that the price to the ultimate user could materially diminish.

Mr. C. O. Silvers (communication) said that during the last 15 months he had had an opportunity of watching very closely an electric cooking and heating installation in a commercial hotel in the Midlands, which for many years had had a great reputation for good cooking. Electricity replaced gas in this case with the following results:—

Up to the end of 1913 electricity for lighting was paid for at the rate of 2½d. per unit (flat rate). The price of gas was 2s. 6d. per 1,000 cb. ft. With the installation of electric cooking the tariff was readjusted as follows:—5d. per unit used, and a fixed charge based upon £8 per kw. demand with a diversity factor for occasional lights, heating and cooking. The apparatus consisted of:—

1 double oven of the Bright unlagged type	3,200	watts
3 800-watt hot-plates	2,400	,,
1 double grill	3,000	,,
1 fish fryer	2,000	,,
4 2,000-watt electric fires	8,000	,,
11 light points	350	,,
	18,950	,,

This apparatus replaced gas, but the following new plant was added:—

1 hot cupboard and carving table	3,000	watts.
2 hot water urns	1,600	,,
1 electric fire	2,000	,,
14 light points	450	,,
	7,050	,,

The actual cost of electricity, coal and gas for the two years preceding the cooking and heating installation and for the first year of electric cooking and heating was as follows:—

	1912.	1913.	1914.
Coal	£35 10 2	£26 16 1	£35 5 0
Gas	47 12 2	53 0 10	13 0 2
Electricity ...	27 15 2	32 0 2	66 13 3
Total	£110 17 6	£111 17 1	£114 18 5

The above figures included no capital charges, but the electricity charges for 1914 included £7 2s. for the hire of apparatus. It must also be remembered that the 1914 figures included additional heating facilities, amounting to at least 2,000 units per annum. On the other hand, they had the installation of an up-to-date coal range for heating water, boiling vegetables and heating plates, &c. The 1912 and 1913 figures were obtained from meter readings taken before December 31st, so that the actual costs were greater than the figures shown. The electricity units for 1914 were taken from January 1st to December 31st, and he might add that the amount of food cooked in 1914 was greater than in either of the preceding years. In his opinion *all* heating and cooking apparatus—in fact, all apparatus which was in any way handled—should be properly earthed, whether in the kitchen or anywhere else. He might say, as a consumer, that the results obtained during a year's working, in which 21,391 units were used at an average cost of 673d. per unit, were eminently satisfactory from a commercial standpoint. The only capital expenditure that had been necessary for these results was that to cover the wiring of a few flat-bottomed pots and pans.

Discussion at Manchester.

Mr. Welbourn said that as the result of about three years' experience of electric cooking he agreed with many of the author's recommendations. Regarding energy consumption, 1½ to 2 kw.-hours per person per day according to season was the average. It was very desirable to mount control switches on the wall, and if the supply was from a three-phase a.c. system a double-pole switch should always be used to isolate the apparatus entirely. Not only cooking apparatus, but every power circuit such as for radiators, &c., should be so arranged that the appliance itself could be earthed. He had used flexibles of various types domestically for about eight years, and had discarded rubber-insulated flexibles entirely and adopted flexibles insulated with asbestos and bound with thread; these were entirely satisfactory after 18 months' use, and withstood heat and ill-usage much better than rubber flexibles. Accurate accounts of the heat bill for a family of eight were kept for two years, which showed a total difference of 25s. between the electric cooking year and the coal year. Electrical energy was supplied at 1d. per unit flat rate with 2½ per cent. discount, and coal cost 17s. 6d. per ton average. The apparatus installed by the author appeared much larger than actually required by the household and would probably accommodate 50 per cent. more persons. The speaker's apparatus had a maximum demand of 4 kw., whereas the author's maximum demand was apparently about 7½ kw. The cost per meal served was heavy when the apparatus was larger than was required. In his opinion the time was near when domestic consumers would be charged on the contract basis involving maximum demand.

Mr. W. Cramp could not understand why electric ovens should not be mounted at a reasonable height. The plan of putting a thermometer on the oven door seemed useless; the proper place was inside. The author seemed very optimistic regarding the question of earthing, when he stated that possibly in those towns where the supply undertaking had a wiring department this part of the work received proper attention. The speaker's experience showed that it did receive proper attention by the wiring department if it was contractors' wiring, but if the wiring department carried out the work, anything would do. A case was recently discovered where a circuit carrying 500 amperes was earthed by Corporation workmen. A No. 18 wire was twisted round a loose nut on one of the switches, and then soldered to the end of a lead water pipe which was hanging loose from a roof. Three contractors were engaged on this installation besides the Corporation, and whilst the former put in enclosed fuses, the latter installed bare wire.

Mr. Alderman Walker thought the electric cooking load was one to be sought after. About a year ago Manchester adopted a new tariff in order to attract the cooking load, viz, 12½ per cent. on the rateable value, plus ½d. per unit metered. It was also stipulated that houses under £30 rental should install 2 kw.; £30 to £50 houses 3 kw.; and over £50 4 kw. The response to the tariff was very poor, and after considerable investigation the cause was found to be the inadequate wiring of the houses originally. A prospective user of cooking plant would not entertain the idea of rewiring his house, involving the destruction of plaster and fittings. A note had been prepared by the department for circulation amongst architects, builders and house owners requesting steps to be taken to ensure sufficient copper being put into new premises to admit of radiator and cooking loads. The capital cost given by the author for the family mentioned seemed excessive.

Prof. E. W. Marchant said the best cooks were the most stupid and he did not believe thermometers to be of any service to such persons. Regarding small electrical appliances, the weak spot was certainly the flexible. The time taken for repairs was usually much too long, and easily replaceable elements were to be advocated. The secondary charge should be kept down in order to induce consumers to use energy. It seemed grossly unfair that the primary charge should have any bearing upon the amount of garden attached to a house; a charge based upon the cubical contents or floor space of the house would surely be more reasonable. The cooking consumer was evidently a very desirable one for the electrical engineer.

Mr. Hollingsworth said that at St. Helens with a rateable value system and a secondary rate of ¾d. per unit they had been fairly successful. The initial outlay on apparatus and wiring was the chief drawback, together with the competition of gas cookers with gas at 2s. per 1,000 cb. ft. There would be no difficulty in meeting the gas competition successfully were it not for the cost of installing and unreliability of large cookers. A large works employed electricity for cooking for 18 months with every success excepting in the matter of reliability. In the hands of experienced cooks the results were far more satisfactory with thermometers than without. The author did not say too much about the necessity of earthing cooking apparatus. The three-pin plug was a very satisfactory device, and it was hardly possible for a negligent wireman improperly to earth apparatus fitted with such plugs.

He advised engineers who had not yet adopted a rateable value or double-charge system to do so, as the half-watt lamp would doubtless arrive and place them in a worse position than when the metallic-filament lamp was introduced.

Mr. W. Eccles gave details of equipment and costs in the case of his own house, assessed at £30, and usually accommodating three adults. The equipment was as follows:—

Electrical—Lighting on a generous scale throughout.
Cooking by means of a cooker comprising oven, grill, hot closet and four boiling plates, also a number of self-contained utensils.
Heating by means of portable radiators.
Power for washing, vacuum cleaning, fans, &c.
Gas— For washing boiler and hot water for house supply when kitchen fire was unavailable.
Coal— During winter only for kitchen and one room fire.
Electricity cost ½d. per unit plus 12½ per cent. of rateable value.
Gas „ 2s. per 1,000 cb. ft.
Coal „ 1s. 0½d. per cwt. approximately.

The accounts were:—

Quarter ending—	Sept., 1914.	Dec., 1914.	March, 1915.
Electricity ...	£2 16 7	£2 12 1	£3 4 5½
Gas	0 16 8	0 6 2½	0 4 0
Coal	0 1 9	1 1 9	2 0 7
	£3 15 0	£4 0 0½	£5 9 0½

which represented about £17 12s. per annum. There had been a saving in laundry, carpet cleaning, baking and charwomen of about £13 per annum. The advantages derived were—

1. Less of the drudgery of housework and increased cleanliness.
2. Comparative independence of maids.
3. Comforts and luxuries otherwise unattainable at any price.

The author's case, whilst being devoid of the aforesaid advantages, except perhaps a little extra cleanliness in cooking, showed a loss of £8 18s. 9d. This loss was reduced to £1 12s. 6d. if the cost of electricity was adjusted to the speaker's rate. Further, coal at £13 10s. per annum for eight or nine persons was very economical, and probably much below the average. On the whole, the author's apparent results were likely to be discouraging to prospective consumers, as the average layman would not trouble about explanations. It appeared that the maker of electrical ovens followed gas-oven practice by constructing tall, narrow ovens, which was quite undesirable. The fact that the lower 6 in. or 8 in. of a gas oven was only utilised for distributing the heat from the burners seemed to be quite overlooked. An electrical oven should never be less than 16 in. × 16 in. plan area, with a height varying from 12 in. upwards, according to the capacity required. The electric grill was practically perfect, but efficient reliable plate warmers and boiling plates were still lacking.

Mr. H. H. Ratcliff thought electric water heating was an expensive luxury at ½d. per unit, and only became worthy of consideration on the score of convenience and cleanliness; ⅛d. per unit was a reasonable financial proposition. The most efficient heaters were, undoubtedly, those of the geyser type, in which water flowed through the heater as required, but there were serious objections, one of which was the enormous KW. demand for a few minutes which would not permit of a reasonable tariff. A further disadvantage was the necessity of reducing seriously the rate of flow in order to obtain high temperatures. Tests carried out on a model heater of this type showed a water inlet temperature of 60° F., outlet temperature 110° F., flow 7¾ gallons per minute, efficiency 98·1 per cent. The load on the meter was 7 KW. The efficiency fell as the temperature was increased, and eventually when a temperature of 200° F. was reached the flow became very unstable and slow, about ¼ gallon per minute, and the efficiency dropped to 94 per cent. The solution of the problem was, undoubtedly the thermal-storage system. Regarding electric cookers, there was not much likelihood of progress so long as the consumer had to purchase his own apparatus.

Mr. Alcock considered it a very difficult matter to interest the ordinary householder in electric cooking so long as the hot water problem was unsolved. Houses at £30 to £50 a year rental had a fire in the kitchen for hot-water supply, and the cooking was done on the fire as a by-product. Regarding the design of cookers, hot-plates, &c., the efficiency of the apparatus was largely dependent upon the intimacy of contact between the vessel and heat elements, and in many types of apparatus the surface of the vessel was ground in an attempt to obtain the desired intimate contact. The gas cooker flame impinged on the vessel to be heated, and this was a good lead for the electrical engineer to aim at in getting the heat element in direct contact with the vessel to be heated. Some such arrangement was being exploited, using heating elements laid in troughs of heat-resisting material, the elements almost touching the vessel.

Mr. A. G. Cooper said that cooking vessels, especially those made of aluminium, were liable to warp after a time. Regarding rateable value, he found the most equitable charge to be 12½ per cent. on £15, 15 per cent. on from £15 to £30, and 20 per cent. for anything over £30 rental.

Mr W. R Cooper, in reply, said with regard to the size of the apparatus, that one must consider not merely the size of one's family in normal times, but the possibility of having people in to dinner and so on. He thought the high price of cooking apparatus was largely a question of establishment charges and experimental costs, which no doubt would come down enormously if the quantity could be increased. The idea of giving notice to builders was an excellent one and ought to do a great deal of good, because the wiring was undoubtedly the difficulty. His cook was very stupid, but he had had no difficulty in getting her to take on the thermometer. Though she does not speak much about degrees, I believes she does not mind talking about 250 in the least. He had been taxed on several occasions with having a high charge for wiring. He thought it was high himself, but the supply undertaking said it was quite normal. The supply undertakings should take this in hand very carefully and decide how cheaply and satisfactorily wiring could be done; it was a very important point.

Mr. George Wilkinson, electrical engineer to the Borough of Harrogate, has found it necessary to address the following letter to the Editor of the *Journal of Gas Lighting*:—

"Dear Sir,—In perusing your 'Electricity Supply Memoranda' in your issue of the 30th, I find that the writer grossly misrepresents my statement as to water heating made during the discussion on Mr. Cooper's paper at the Institution of Electrical Engineers. Moreover, your writer casts aspersions upon the cleanliness of myself and members of my family which appear to me to be in very bad taste.

"What I actually said was that the electric heater has a cubical capacity equal to 12 gallons, but it is equal to an output of over 60 gallons of water per day at 100° F., which, I think, you will agree is a fair supply for a small household; it is found sufficient for two or three baths per day in addition to the ordinary kitchen requirements.

"I have facilities for the production of ten times this amount of hot water if necessary, but the output of the electric heater is found ample for ordinary every-day demands.

"I hope you will do me the justice to have this matter put right in your next issue.

"Yours faithfully,
"(Signed) Geo. Wilkinson."

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Glassware to Give Sunlight Colour Value.

In response to a number of inquiries for glassware which will ensure artificial light of daylight value, the British Thomson-Houston Co., Ltd., of Mazda House, 77, Upper Thames Street, E.C., are putting on the market a complete range of colour matching pendants and globes. The name "Trutint" has been given to this glassware, and it is available in various compositions to ensure different sunlight values.

In Group I, the composition of the glass is such as to ensure accurate matching in colour comparison work; this particular unit is not intended for general room lighting, and is only available as a pendant reflector unit, without cabinet, for use where there is little extraneous light to interfere with colour matching. Group II is for general illumination, and gives a light of "noon" sunlight value; it is particularly suitable for lighting in paint shops, lithographic plants, art galleries, &c. The watts per candle efficiency of Mazda half-watt lamps when fitted with this particular type of globe is practically equivalent to that of standard Mazda lamps in a white opal globe.

Group III is also for general illumination, and gives a light of "afternoon" sunlight value. The purpose of the Trutint globes in this case is to furnish a light that is slightly more efficient in watts per candle than Group II, and necessarily somewhat yellower, as is the case with afternoon sunlight. The Trutint globes in this group, therefore, compromise between colour and efficiency, and their field will be found in the general lighting of dry goods and clothing shops, or in other positions where daylight quality of light is desired. They are made of Trutint glass cased over by a light opal, or a very light opal body in which Trutint has been mixed, and are known respectively as "Trutint Cased" and "Trutint Opal." The cased glass appears white when unlighted, while the other units appear bluish. When possible complete installations of Trutint glass should be obtained, so that the yellow light of other lamps may not be present.

Trutint glassware is not made for use with ordinary Mazda lamps; it has been specially compounded for Mazda half-watt lamps, which, owing to their high intrinsic brilliancy, are more like sunlight in colour than previous incandescent lamps.

A Parsons Paraffin Motor.

The Parsons Motor Co., Ltd., of Southampton, have recently built a number of 90-H.P. six-cylinder paraffin engines, both for commercial and Government orders.

The type of engine is a regular pattern 90-H.P. six-cylinder set, having cylinders 6½-in. bore and 8-in. stroke, and running at 550 R.P.M.

The leading features of the design are that the pistons and connecting rods are removable through crank chamber doors, without detaching the cylinders or separating the crank chamber. There is a complete system of pump lubrication, combining an oil cooler on the engine, and including the usual relief valve, pressure valve and level gauge, and in order to keep down heat from the external surfaces of the vaporisers they are water cooled, and are arranged for starting by blow lamp or petrol. The engine has its own pumps for circulating the water through the cylinder jackets, &c., and these jackets are carried right down to the base, keeping the engine very cool; a centrifugal high-speed governor is mounted at one end, and controls the speed within close limits.

These engines are supplied with or without compressed-air starting, and it will be seen that there is a chain turning-over gear at one end; in the example shown there is a separate air compressor driven by a friction clutch, which can be disengaged by a foot lever.

At the fly-wheel end of the engine there is a distributing valve which admits pressure air to all six cylinders in turn, thus ensuring a quick start, the cylinders, of course, being fitted with non-return valves.

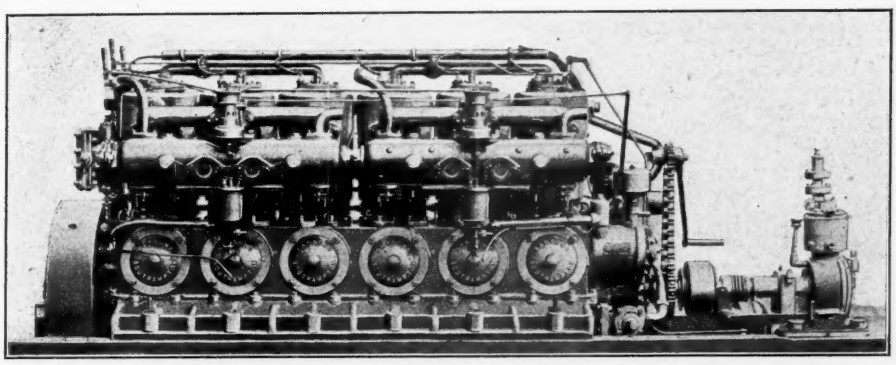


Fig. 1.—Parsons 90-h.p. Paraffin Engine with Compressed-Air Starting.

A good point about these engines is that any fumes venting from the crank chamber are not allowed to pass into the engine room, but are drawn through and consumed.

Several of these engines have recently been put down for the generating stations at various military camps throughout the country, and a number are in use also by the Admiralty in different types of craft.

The weight of the engine shown approaches a couple of tons.

PRIVATE GENERATING PLANT.

On taking the chair as the first President of the Association of Supervising Electricians, Mr. A. H. Dykes delivered an address on "Private Generating Plants," of which the following is an abstract:—

The voltage of supply, and therefore the number of cells, depends on the length of main to the light farthest from the battery room. In a case where an installation on completion did not give satisfaction, I found that the battery was a 50-volt one, and that owing to the house being a long, straggling one, at the far end there was a blink in the lights every time other lights were turned on or off. The remedy was obvious, especially as the battery was small for the work—it was to double the number of cells and raise the voltage to 100.

In several cases where the lights were spread over a large area, and the dynamos were situated a considerable distance from the cell room, I have wired the premises on the three-wire system, with two batteries of 100 volts each, the two batteries being charged in series at 200/260 volts, with a change-over switch, so that the cells are changed over each day from one side of the system to the other, in order to ensure that each half of the battery gets approximately the same amount of use. This plan enables one to use small candle-power 100-volt lamps, whilst obtaining the economy in the mains and sub-mains due to 200-volt distribution.

Experience tells me that the owner of a house never complains that his cells are too large, but does very frequently blame somebody because his cells were not put in large enough in the first place. A safe rule to follow is to decide the maximum number of ampere-hours likely to be taken from the battery on the longest winter's day, and then make the capacity of the battery double this, thus enabling the supply to be given from, say, Saturday morning till Monday morning, without having to run the engine. In summer time it will only be necessary to charge once or twice a week.

By capacity I mean not the capacity of a new battery, but the capacity the makers will guarantee under a maintenance policy, which with some makers is only 80 per cent. of the listed rating of the cell.

Since the introduction of the metal-filament lamp the capacity of the cells required for lighting has been very greatly reduced, but, on the other hand, the use of small motors and heating appliances is becoming much more general, and a few radiators used for some hours every night need a considerably augmented battery power.

Wherever possible I prefer to have the cell room as near as possible to the house, putting the engine and dynamo in a separate house far enough away to avoid annoyance from smell or noise. If the battery and engine room are together, it generally means that they are some distance from the house, and as the maximum current of the battery is generally in excess of the dynamo current, the mains from the engine room to the house have to be larger, and consequently more costly, than they need be.

To give good regulation also, the drop from the cells to the end light must be small, which again means increasing the cable to the house.

By putting the batteries up at the house, the size of the mains from the engine room can be kept down merely to the size necessary to carry the charging current of the battery, and, if necessary, quite a considerable drop in voltage may be allowed in them.

A battery regulating switch, suitably enclosed, with merely a regulating handle projecting, can be fixed in the wall of the battery room looking into a passage, and any one of the indoor servants can be told off to move the handle one way or the other, so as to keep the pointer of the voltmeter fixed over it at a definite point.

I generally fix the size of the engine to give the specified charging current at about 2·2 volts per cell, which means that at the end of the charge, when the voltage has risen to, say, 2·6—2·7 volts, the current falls off, thus giving an economical rate of charge.

In only a very few cases in this country is there water power of practical use available; and in most cases some form of heat engine is employed. In certain special cases where steam is required for heating, and the exhaust steam, after passing through the engine, can be utilised, the steam engine is the most economical source of power, but such cases generally arise only in works or business premises where little or no light is used in the summer, but only in the winter, when steam is wanted for heating as well.

Where town gas is available, a gas engine, with belt-driven dynamo, makes a good combination, especially as the engine can be always run at its most economical load when charging the battery. Taking an average figure of 35 cb. ft. per unit generated by the dynamo, with gas at, say, 3s. 6d. per 1,000 cb. ft., the cost of fuel per unit generated is 1·46d.

Not more than 60 per cent. of the total energy generated by the dynamo can be obtained from the battery, and thus the cost per unit actually used in the lamps will be 2·43d. for fuel alone.

Where town gas is not available, a suction gas producer is frequently used, consuming anthracite, or, in some cases, coke. The actual consumption per unit generated during last year of such a plant put in to our specification at a large country house was 2·2 lb. of anthracite at 26s. = 0·31d. Such plants are simple and easy to work, but like the steam boiler, are not so economical when worked only intermittently as when they are in regular use all day long. This difficulty is overcome by the different forms of oil engines, none of which consume any fuel except when they are actually at work.

The engines which are most generally used are horizontal single-cylinder oil engines burning paraffin. They are very simple, quite reliable, easily started to work, and can be safely left in the hands of any intelligent gardener. The consumption of paraffin is about 1 pint per unit generated, which, at 7d. per gallon, costs 0·875d. per unit.

The petrol engine, direct-coupled to its dynamo, has been largely used for country house lighting. It makes a very neat, compact set, and is easily understood by the chauffeur, who is mostly to be found on large estates. The consumption of petrol per unit generated is about 1½ pints, which, at 1s. 9d. a gallon, costs nearly 4d., so that as regards fuel costs these sets do not compare favourably with paraffin engines. There is more risk of fire, due to the use of the inflammable petrol instead of the heavier paraffin oil, and the electric ignition certainly gives more trouble than the hot-bulb ignition. Whereas one of the horizontal paraffin engines can, and will, run for years with nothing more than ordinary cleaning and attention by a more or less unskilled attendant, the petrol engine must have constant supervision.

The Diesel engine burns the cheapest of oil fuel—the crude or residue oil of about the consistency of treacle.

The consumption of crude oil is only about 0·7 lb. per unit generated. At an average price of 60s. per ton, the fuel cost per unit generated works out at 0·225d., but the first cost of the Diesel engine is very high, and very skilled attendance is necessary, so that except in special cases, where the plant is worked very long hours and the cost of fuel is therefore very important, it is not suitable for private lighting plants.

Questions on various points were dealt with by the author. With many reservations, he thought the average life of a battery was probably seven years, but he could point to cases where batteries were in existence after 15 years of working, and they were at the present moment up to full guaranteed capacity; that was because a maintenance contract had been entered into with the makers, and the plates renewed by them from time to time as necessary. The extra cost of petrol over paraffin in very small sizes was negligible, and direct-coupled petrol sets were very satisfactory for small power generators if not run at too high speed. In practice it was generally found that automatic plant required

frequent skilled attention. A maintenance contract with the makers of a battery relieved the owner of a great deal of responsibility; and the amount paid for upkeep was really depreciation as well, as the makers would guarantee to keep the battery up to its full capacity.

BRITISH ELECTRICAL PATENTS APPLIED FOR OR COMMUNICATED BY RESIDENTS IN GERMANY, AUSTRIA OR HUNGARY.

The following list of British patents, applied for or communicated by residents in Germany, Austria and Hungary will be found of interest to manufacturers or others desiring to avail themselves of the provisions for Compulsory Licence under the new Patents Act. Intending licensees should, however, not assume without further enquiry that any patent in the list is not already assigned or licensed or that the applicant is an "enemy subject."

The list is specially compiled for the ELECTRICAL REVIEW by Messrs. W. P. THOMPSON & Co., 285, High Holborn, W.C., and 6, Lord Street, Liverpool.

1905.

14,320.—Siemens Schuckertwerke Ges., Berlin. Electric motors.
16,292.—M. Kallmann, Berlin. Electric motors.
16,300.—Siemens Bros. & Co., London (communicated by Siemens Schuckertwerke Ges., Berlin). Dynamo-electric machines.
18,264.—W. & H. Heraeus, Hanan/Main. Electric lamps.
19,138.—Allgemeine Elektricitäts Gesellschaft, Berlin. Dynamo-electric machines.
19,379.—Deutsche Gasglühlicht A.G. (Auer. Ges.), Berlin. Electric lamps.
25,147.—Elektrizitäts A.G. vorm. W. Lahmeyer & Co., Frankfurt/Main. Dynamo electric machine.
25,393.—Elektrizitäts A.G. vorm. W. Lahmeyer & Co., Frankfurt/Main. Electric motors.
26,094.—Allgemeine Elektrizitäts Ges., Berlin. Dynamo-electric machines.
27,251.—P. Müller, Friedenau. Electric lamps.

1906.

16,818.—Allgemeine Elektricitäts Ges., Berlin. Measuring electricity.
18,486.—Allgemeine Elektricitäts Ges., Berlin. Electric switches.
19,239.—Allgemeine Elektricitäts Ges., Berlin. Dynamo-electric machines.
20,808.—Allgemeine Elektricitäts Ges., Berlin. Dynamo-electric machines.
21,348.—H.P.R.L. Pörscke, Hamburg. Galvanic batteries.
21,585.—Siemens & Co., Geb., Charlottenburg. Electric conductors.
22,323.—F. Münz, Stuttgart. Magneto electric machines.
22,605.—Siemens Schuckertwerke Ges., Berlin. Dynamo-electric machines.
23,309.—I. B. Birnbaum (communicated by Telephon Fabrik A.G., vorm., J. Berliner, Hanover). Telephone systems.
24,973.—A. Lederer, Vienna. Electric lamps.
25,306.—Siemens Bros. & Co., London, and W. Dieselhorst (communicated by Siemens & Halske A.G., Berlin). Electric conductors.
27,318.—K. Schaffler & D. Weiss, Vienna. Dynamo-electric machines.
27,318A.—K. Schaffler & D. Weiss, Vienna. Dynamo-electric machines.
27,318B.—K. Schaffler & D. Weiss, Vienna. Dynamo-electric machines.
27,499.—Siemens & Co., Geb., Berlin. Dynamo brushes, electric contacts.
28,562.—F. Krupp A.G., Essen. Dynamo-electric machines.
28,775.—Deutsche Gasglühlicht A.G., Berlin. Electric lamps.
29,647.—F. Merk, Berlin. Telephone systems.

1907.

633.—Allgemeine Elektricitäts Ges., Berlin. Dynamo-electric machines.
1,242.—Siemens Schuckertwerke Ges., Berlin. Electric motors.
1,267.—G. Stübgen & J. Stübgen, Erfurt. Lamps.
1,662.—Allgemeine Elektricitäts Ges., Berlin. Dynamo-electric machines.
2,499.—Siemens Bros. & Co., London (communicated by Siemens & Halske A.G., Berlin). Telephone systems.
3,174.—Siemens & Halske A.G., Berlin. Tungsten filaments (reg.).
3,938.—Consortium fur Electrochemische Industrie Ges., Nurnberg. Electric lamps, bending metals (reg.).
6,527.—Allgemeine Elektricitäts Ges., Berlin. Measuring electricity.
6,715.—Siemens Bros. Dynamo Works, London (communicated by Siemens-Schuckertwerke Ges., Berlin). Dynamo-electric machines.
6,929.—Siemens & Halske A.G., Berlin. Electric telegraphs.
7,320.—Salpetersäure-Industrie Ges., Gelsenkirchen. Electric furnaces.
8,264.—Ges. Für Drahtlose Telegraphie, Berlin. Wireless telegraphy.
8,563.—Deutsche Gasglühlicht A.G. (Auerges), Berlin. Electric lamps.
9,499.—Deutsche Beckbogen-lampen Ges., Frankfurt/Main. Electric lamps (reg.).
10,024.—Farhwerke vorm. Meister Lucius Bruning, Hoechst/Main. Electric endosmose.
10,356.—W. G. Schmidt, Dortmund. Dynamo-electric machines.
10,452.—Allgemeine Elektricitäts Ges., Berlin. Electric traction.
10,972.—Porzellenfabrik Kahla Filiale Hermsdorf-Kloster Lausnitz, Hermsdorf, Sachsen-Altenburg. Electric insulation.
11,549.—Allgemeine Elektricitäts Ges., Berlin. Electric motors.
11,594A.—Allgemeine Elektricitäts Ges., Berlin. Electric motors.
11,716.—Siemens & Halske A.G., Berlin. Electric lamps; tungsten compounds.
12,090.—Allgemeine Elektricitäts Ges., Berlin. Dynamo-electric machines.
13,071.—Siemens & Co., Geb. Charlottenburg. Electric lamps.
14,440.—Allgemeine Elektricitäts Ges., Berlin. Electric switches.
14,725.—Siemens Bros. Dynamo Works, London (communicated by Siemens Schuckertwerke Ges.). Regulating electric currents.
15,020.—C. Thâmer, Danziglangfuhr. Dynamo meters.
15,510.—Deutsche Gasglüglicht A.G. (Auerges), Berlin. Electric lamps.
16,489.—Siemens & Halske A.G., Berlin. Tungstates.
16,503.—Deutsche Gasglühlicht A.G. (Auerges), Berlin. Electric lamps.
16,529.—Allgemeine Elektricitäts Ges., Berlin. Electric motors.
16,867.—H. Süssmann, Berlin. Lamps.
18,043.—H. Schmidt, Cologne. Electro-deposition metallic hollow ware.
18,163.—Siemens Bros. & Co., London (communicated by Siemens & Halske A.G., Berlin). Telephone systems.
18,480.—H. Schmidt. Cologne-on-the-Rhine. Electrolysis.
19,562.—Deutsche Gasglühlicht A.G. (Auerges), Berlin. Electric lamps.
19,672.—Ges. für Verwertung Chemischer Produkte, Berlin. Electric lamps.
20,229.—Allgemeine Elektricitäts Ges., Berlin. Electric switches.
20,300.—Allgemeine Elektricitäts Ges., Berlin. Electric traction.
20,372.—V. Scholz, near Berlin. Electric lamps.
20,867.—Allgemeine Elektricitäts Ges., Berlin. Dynamo-electric machines.
21,460.—Siemens Bros. Dynamo Works, London, C. Altmann, Stafford & W. Lan, Nurnberg. Dynamo-electric machines.
21,860.—Siemens Bros. Dynamo Works, London (Siemens Schuckertwerke Ges., Berlin). Electric insulation.
23,448.—Allgemeine Elektricitäts Ges., Berlin. Dynamo-electric machines.
24,028.—Wolfram Lampen A.G., Augsberg. Electric lamps.
24,135.—Allgemeine Elektricitäts Ges., Berlin. Dynamo-electric machines.
25,744.—Felten & Guilleaume-Lahmeyerwerke A. Ges., Frankfurt-Main. Electric distribution.
26,084.—W. Meyerling, Charlottenburg. Measuring electricity.
26,436.—R. Bosch, Stuttgart. Sparking plugs.
26,530.—Ges. für Drahtlose Telegraphie, Berlin. Wireless telephony.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

4,483. "High-tension protective device." F. B. DEHN. March 22nd. (Schweitzer & Conrad, United States.) (Complete.)
4,524. "Electric candle lamps." C. DAMEY. March 23rd.
4,560. "Dynamo-electric machines." BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD. March 23rd. (Convention date, March 23rd, 1914, United States.) (Complete.)
4,561. "Electric switches." IGRANIC ELECTRIC CO., LTD. March 23rd. (Cutler-Hammer Manufacturing Co., United States.) (Complete.)
4,564. "Electric motors." F. HORNBY. March 24th.
4,575. "Electrolytic process for the production of iron tubes, sheets, and the like, with an incorrodible surface." S. O. COWPER-COLES. March 24th.
4,576. "Process for the electro-deposition of lead." S. O. COWPER-COLES. March 24th.
4,577. "Process for the electro-deposition of iron." S. O. COWPER-COLES. March 24th.
4,582. "Telephone systems." A. B. SMITH. March 24th. (Convention date, March 25th, 1914, United States.) (Complete.)
4,585. "Protection of electric cables." J. H. BOWDEN & H. F. J. THOMPSON. March 24th.
4,588. "Rheostats." L. KAMM. March 24th.
4,595. "Protection of alternating-current electric systems. BRITISH THOMSON-HOUSTON CO., LTD., & E. B. WEDMORE. March 24th.
4,600. "Electric heating element for kindling." R. K. HEARN. March 24th.
4,604. "Receiving instrument for wireless telegraphy." F. L. FIELD, C. L. FORTESCUE & B. S. GOSSLING. March 24th.
4,606. "Imitation candle lamps." W. J. OWEN, C. M. ESCARE & P. F. ESCARE. March 24th.
4,615. "Purification of tungsten and tungsten compounds." P. PERRINO and G. SESTI. March 24th.
4,625. "Production of zinc by electrolysis." M. PERREUR-LLOYD. March 24th. (Convention date, May 28th, 1914, France.) (Complete.)
4,658. "Electrolytes for the electro-deposition of zinc." S. O. COWPER-COLES. March 25th.
4,663 "Electric torches and other forms of electric hand lamps." A. H. ROSE & T. A. ROSE. March 25th.
4,664. "Magneto-electric machines." BRITISH THOMSON-HOUSTON CO., LTD., and A. P. YOUNG. March 25th.
4,675. "Mine and other signalling systems." STERLING TELEPHONE AND ELECTRIC CO., LTD., & H. W. BARCLAY. March 25th.
4,681. "Apparatus for the electrolytic production of metals." M. PERREUR LLOYD. March 25th. (Convention date, May 28th, 1914, France.) (Complete.)
4,686. "Sparking-plugs for internal-combustion engines." A. E. LAMKIN. March 25th.
4,697. "Testing means for sparking-plugs." A. E. LAMKIN. March 25th.
4,706. "Process for coating metallic articles with lead." S. O. COWPER-COLES. March 26th.
4,719. "Magnetic clutches." M. WALKER and SMITH & COVENTRY, LTD. March 26th.
4,722. "Electric arc lamps." A. ROLINSON & J. G. WILSON. March 26th.
4,738. "Protection of alternating-current electric systems." BRITISH THOMSON-HOUSTON CO., LTD., & E. BASIL WEDMORE. March 26th.
4,747. "Electric motor controllers." IGRANIC ELECTRIC CO., LTD. March 26th. (Cutler-Hammer Manufacturing Co., United States.) (Complete.)
4,748. "Circuit controllers." G. R. RADLEY. March 26th. (Convention date, March 30th, 1914, United States.) (Complete.)
4,761. "Improvements in electrical cables, specially applicable to cables having a protective sheathing of rubber." BRITISH INSULATED & HELSBY CABLES, LTD., and J. BROTHERTON. March 27th. (Complete.)
4,766. "Electric switches." ELECTRIC & ORDNANCE ACCESSORIES CO., LTD., and J. ETCHELLS. March 27th.
4,776. "Manufacture of filaments, rods, and other bodies consisting of, or containing, graphite-like carbon." SIEMENS & HALSKE AKT. GES. March 27th. (Convention date, March 28th, 1914, Germany.) (Complete.)
4,795. "Phase advancers for dynamo-electric machines." G. KAPP. March 27th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d., (in stamps).

1913.

28,277. LINE OR WIRELESS TELEGRAPH SYSTEMS. W. H. Shephard & A. E. McKechnie. December 8th.
28,278. LINE OR WIRELESS TELEGRAPH SYSTEMS. W. H. Shephard & A. E. McKechnie. December 8th.

1914.

3,181. ELECTRO-CHEMICAL TREATMENT OF LIQUIDS. C. P. Landreth. February 6th. (February 21st, 1913.)
5,321. RAILWAY SIGNALLING APPARATUS. J. F. Wolff. March 2nd. (Fielding.)
5,639. AUTOMATIC ELECTRIC REGULATORS. British Thomson-Houston Co. (General Electric Co.). March 5th.
5,662. SUSPENSION OF ELECTRIC AND OTHER LAMPS AND OTHER ARTICLES. G. A. Hughes. March 5th.
6,070. ELECTRIC SWITCHES OR CIRCUIT BREAKERS. F. B. Holt. March 10th.
6,077. METHOD OF SYNCHRONISING A MOVING PICTURE MACHINE WITH A TALKING MACHINE OR WITH MUSIC, AND A FILM TO BE USED THEREWITH. E. S. Donisthorpe. March 10th.
6,162. ELECTRIC SWITCHES. Western Electric Co. (F. T. Woodward acting for Western Electric Co.). March 11th.
6,173. ELECTRIC LIGHT REFLECTORS. G. A. Allom. March 11th.
6,180. ELECTRIC SWITCH APPARATUS FOR USE IN CONNECTION WITH THE ELECTRIC LIGHTING AND HEATING EQUIPMENTS OF RAILWAY AND OTHER VEHICLES. Electric and Ordnance Accessories Co. & J. Etchells. March 11th.
6,209. ELECTRICAL IMPULSE TRANSMITTERS AND THE LIKE. Betulander Automatic Telephone Co. & W. Aitken. March 11th.
6,575. LEYDEN JARS AND LIKE CONDENSERS. E. Rousseau. March 16th.
7,900. CONTROLLING SWITCHES FOR ELECTRIC CIRCUITS. V. E. Joyce and Spagnoletti, Ltd. March 28th.
8,052. RECORDING MECHANISM FOR USE WITH ELECTRIC MEASURING INSTRUMENTS. J. S. Withers (Sander). March 30th.
8,286. SAFETY DEVICES FOR ELECTRICAL WINDING MECHANISM. H. Wauchope and Stothert & Pitt, Ltd. April 1st.
10,895. ELECTRICAL CONDENSERS AND THE MANUFACTURE THEREOF. G. Giles. May 2nd. (May 29th, 1913.)